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July/August
1984

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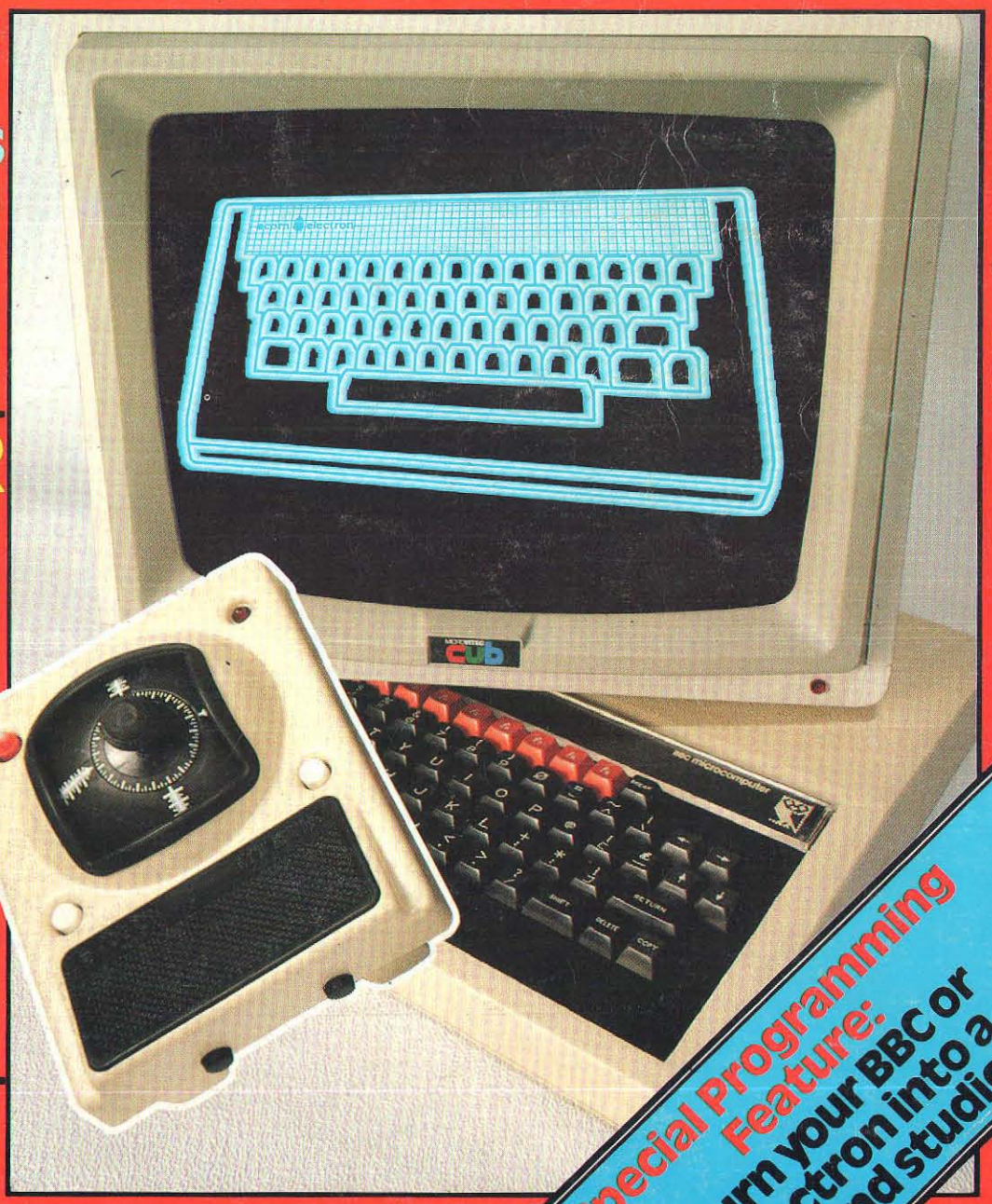

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A&B

Volume One Number

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A&B Computing is constantly on the look-out for well-written articles and programs for publication. If you feel that your efforts meet our standards, please feel free to submit your work to us for consideration for publication.

All submitted material should be printed or typed, double spaced. Any programs submitted should be listed (55 character width emphasised if possible). A cassette of the program alone will not be considered. All programs must come complete with a full explanation of the operation, and where relevant, the structure. We also require the program in machine readable form (cassette, 40 track 5¼", or 3" disc) plus any suitable screen photographs, printer dumps and so on.

All submissions will be acknowledged and the copyright in such works which will pass to Argus Specialist Publications Limited will be paid for at competitive rates. All work for consideration should be sent to the Editor at our Golden Square address.

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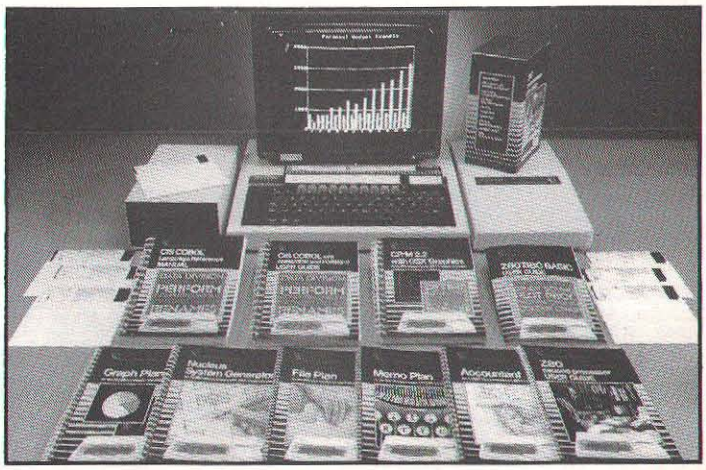

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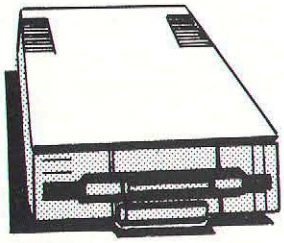

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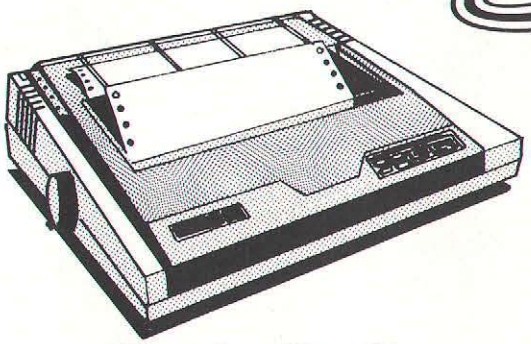

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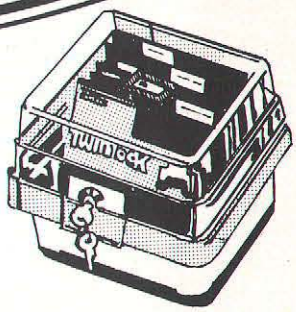

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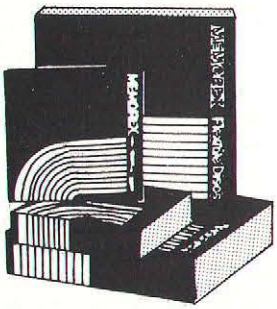

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Menu

Great news for all *A&B Computing* readers: we are going to appear at monthly intervals from now on. Yes, the same *A&B Computing,* packed to the gunnels with up to date product reviews, advice on software and hardware, programs from the arcade and the classroom, high quality software for you to type in. But twice as often and at half the price, now only £1.00.

The October issue of *A&B Computing* will appear on the shelves on the first Friday of September so don't miss out. Place a regular order with your newsagent by cutting out or photocopying the order form below.

The new monthly version will provide the same thorough coverage of all matters BBC and Electron. The autumn is sure to bring a flood of brand new exciting add-ons and software for both computers and we will keep you up to date with comprehensive reviews.

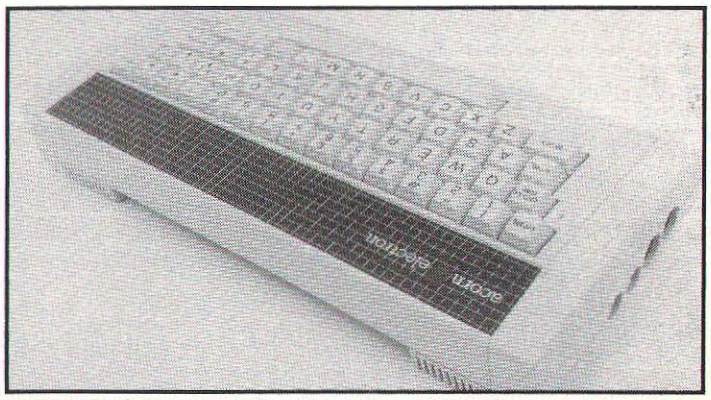
Regular contributions on advanced programming, including the triumvirate of sound, graphics and assembly language, will continue to open up new avenues of exploration. We will also be linking the BBC up to outside devices including robots and providing software for you to learn about interfacing your micro.

Newcomers to the BBC and Electron will find our well documented listings to be a great help as they learn through programming. Newcomers to BASIC can follow our Walk Before You Run series.

Nor will our articles and programs be confined to the narrow limits of the hardware. They will be concerned with where and when best to exploit the power of your computer and how to make it useful in the real world, around the home, in business and for home education. Witness the current issue. The blend will remain the same but you will get more value for your money, more often.

As you sit (or lie?) in the sun reading this issue, interest is focussed on the Acorn acquisition of Torch and the coincidence with the launch of the Acorn Z80. In future magazines we will be following the upgrade paths provided by both. Since we are all users of BBC BASIC, Dr Barry Landsberg's article on 'Quirks' in our favourite lingo should prove fascinating reading.

Hopefully we can also persuade you to retire once more into the shade and type in some of the excellent programs on offer. Notemaster and Europe are great fun and Snackman is a brilliant interpretation of the original you know what. Role on the first Friday in October.



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News

BBC STARS AT LIVERPOOL INTERNATIONAL FESTIVAL

When the Queen and the Duke of Edinburgh opened the international garden festival at Liverpool, they also opened up a brand new computer information system which features the BBC Micro.

ITM, Information Technology and Marketing which operates from one of Merseyside Development Corporation's New Enterprise workshops at Brunswick Dock, has developed an information system which works along similar lines to Ceefax, Oracle and Prestel. The system is actually based on the Viewdata format and utilises off the shelf BBCs (thus keeping the price down). The BBCs act as independant units around the site, with software to run each unit. At the same time they are networked to a central terminal from where individual editing can take place or global editing of the whole system.

Each unit has a string of monitors on which are displayed teletext graphic displays interacting with video sources. Hi-res modes are also used. The frames of information are predefined and sequenced over up to 250 channels with 80 in any one sequence. The interaction with video, be it for display or advertising, is also predefined. Each frame can be displayed for variable lengths, scrolled in from top, bottom or side of the screen or built line by line. The software is stored by the unit on floppy disc, with a full editing suite of software at the main terminal to swop things about. There is also a tic-a-tape cursor at the bottom of each screen keeping visitors up to date with the latest information.

The system will provide a rolling information catalogue of the days events, competitions, and horticultural shows, constantly updated from the Rotavision Editing station which is on view to the public in a magnificent glasshouse within the Festival Hall.

The system took 12 months to perfect against a background of staff who had previously worked with Videotex, and was installed in conjunction with British Telecom. Plans exist to extend the system to allow the BBCs to act as interrogation terminals, with customer enquiries, special offers and advertising at point of sale.

ADD-ON A CUBE

Both 6502 and 6809 second processors are now available from Control Universal of Cambridge. The 6502 is a multi-function, single board computer which can be thought of as a stripped down, industrially presented equivalent of the BBC Micro. The MOS allows it to run sideways ROMs such as BASIC. Communicating through its serial port, EuroCUBE-65 (as it's known) runs as a second processor to the Beeb. It can however operate independantly and drive its own peripherals such as hi-res colour video. Prices start at £167 (ex.-VAT).

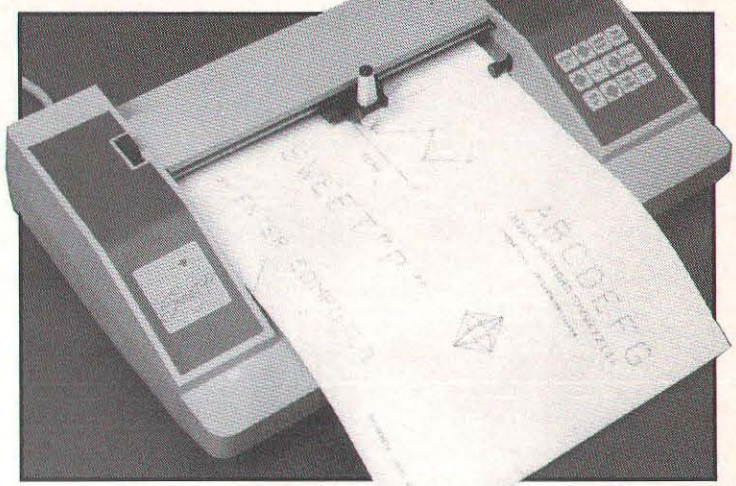
The 6809 includes a CU-NINE 6809 CPU card, a CU-DRAM 64kB memory card and a Tube interface for connection to the BBC. The package known as CUBE BeebFLEX allows the BBC to run the wide range of FLEX software. Further information from Control Universal Ltd., Anderson's Court, Newnham Road, Cambridge CB3 9EZ. Tel: 0223 358757.

SWEET-P PLOTTER

HALL Computers have introduced a low cost flat bed plotter which can be used with the BBC. Priced at £498, the model 100 could be the ideal hardware to generate hard copy graphics from the new business and CAD systems available for the BBC.

Sweet-P interfaces through the Centronics port and will plot graphs and illustrations on any type of paper and transparent film. Plotting speed is 6 inches per second with a resolution of 250 steps per inch.

The model 100 incorporates its own graphics language (SPGL) with 19 commands that control drawing vectors, text and special functions such as page size and length. Both plotting speed and alphanumeric size are adjustable. Further information from HAL Computers,Invincible Road, Farnborough, Hants GU14 7QU. Tel: 0252 517171.



Sweet-P

GNOMIC INTERFACING

General Northern Microcomputers Ltd have followed their successful production of disc interfaces for other micros with an Acorn compatible BBC disc interface. The main attraction of the Gnomic designed interface is QFS, a disc filing system written by Gnomic which supports single or double density with automatic density recognition and 40 or 80 tracks.

The system also allows up to 256 files and 800K storage on a single disc. It sounds like a winner and Gnomic are selling them for £95 +VAT. There is no doubt that the interface famine will push buyers over to filing systems other than Acorn's own. Further information from General Northern Microcomputers Ltd., 2 Whitworth Road, South West Industrial Estate,Peterlee, Co. Durham, SR8 2JJ. Tel 0783 860314.

TORCH REKINDLED

Torch Computers, who use the BBC Micro as the basis of its advanced range of business computer systems, is to be acquired by Acorn Computer Group PLC themselves. Chris Curry and Bob Gilkes, Chairman of Torch, signed Heads of Agreement for the aquisition of Torch by Acorn at the beginning of May.

The move seems very sensible since the two companies have a high degree of compatability in products and rationalisation of the two companies' development efforts can only benefit both parties. Torch is to retain its name and will be an entirely separate entity within the growing Acorn empire.

At the same time Torch are rekindling interest in both the upper and middle range products in which they specialise. They have announced the addition of MS-DOS and the 8088 to their range of business machines.

The 388 model will cost £1,995 (excluding VAT) and offers both the 64K Z80, the BBC Micro Model B and a 256K 8088. The three operating systems (BBC MOS, CP/N and MS-DOS) are included in the price. Torch are still providing the widest range of product and systems for the basic BBC controller but the price is going up.

The Unicorn range of products newly launched by Torch is designed to make available a lower cost upgrade path for BBC owners. The Z80 is now available on its own as well as in the well known disc pack. Also in the

ws News

range is a 20Mb hard disc pack for the BBC and the UNICORN 68000 20Mb pack with UNIX operating system, a system which Torch have committed themselves to support extensively.

New product includes a 20Mb disc pack for 388 and 301 workstations. Torch also made it clear that they intend to develop into ambitious new areas such as image processing and speech recognition. Closer to home for the time being though is their new UNICOMM package. The package is available mail order only from Torch and costs just £185 including VAT. In all you get a BT approved modem, UNIMAIL electronic mail, UNITERM 60 Mailframe Communications package, UNIVIEW Prestel compatible Viewdata system and Telesoftware downloading. Further information from Torch Computers Ltd., Abberley House, Great Shelford, Cambridge, CB2 5LQ. Tel: 0233 841000.

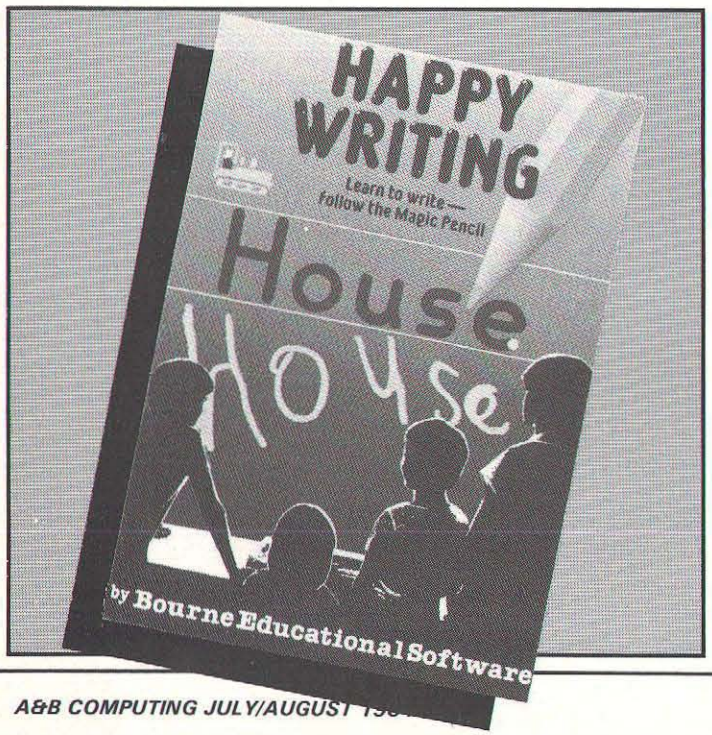
ROM MANAGER

Watford Electronics have come up with the answer to the considerable problem of handling the sideways ROM facility of the BBC. Called Manager, the ROM (of course) offers a host of commands to select which ROM you require a command to be passed to (avoiding clashes between * commands) plus facilities to allow the design and testing of ROM software in the computer's memory before blowing into EPROM.

Manager offers the ability to check up on the status of any of your ROMs, what is does, where it is, what it is actually on it plus the effects it has upon th computer (key definitions and so on). So if your ROMs are getting out of hand perhaps you had better get in touch with Watford Electronics, 33/35 Cardiff Road, Watford, Herts. WD1 8ED. Tel: 0923 40588.

HAPPY WRITING FOR YOUNGSTERS

Bourne Educational Software have a new program available for children between the ages of three and five years. Designed to encourage children to start learning to write in the right way, the program uses a 'Magic Pencil' to help children learn to form their letters and numbers correctly.



The program benefits from the usual Bourne testing in a number of schools. Included are options for change of writing speed, use of, or change to, internal word list and the popular adjustment of sound level.

Features designed to hold the attention of the young user include lines being drawn by tractors, reward tunes and a 'Magic Pencil' with their name on it. The program costs £8.97 on cassette and is available for both the BBC Micro and the Electron. BBC disc costs £10.98.

NO ROOM FOR VIEWBASE

Acornsoft have prevented the use of the name 'VIEWBASE' for the Silversoft database developed for use with the Acornsoft wordprocessor 'VIEW'. Acornsoft felt that the prefix VIEW was a registered trademark, and threatened legal action.

The database, now known as Index retains its ability to link with VIEW thus making mailshot preparation from database records relatively easy. An enhancement to the original program, which costs £24.99, has meant a late release for Index but Silversoft consider it a very worthwile addition since it allows the user to redefine file structures without corrupting data, thus allowing maximum use of avialable disc space.

The database supports 30 characters per field, 15 fields per record, maximum 250 characters per record. Available on 40 or 80 track from Silversoft Ltd., London House, 271-273 King Street, London, W6 9LZ. Tel: 01 748 4125.

GROWTH OF GRIFFIN EDUCATIONAL RANGE

Four new software packages are now available from Griffin Software to help develop English and Maths skills and aid revision for O level and CSE exams.

Mathskills 1 and 2 include long multiplication and division, areas and perimeters, simple equations, sets and Venn diagrams. Englishskills 1 and 2 deal with topics like metaphors, opposites, parts of speech and proverbs and similes. All the programs deal with basic concepts and are designed to reinforce the learning with teach and test routines, thus making them ideal for revision purposes.

Full documentation is included and a certificate is displayed at the end of each program telling the student how many questions he/she has got right and wrong. Each pack costs £11.95.

JUST TRY GETTING INTO 'HAUNTED ABBEY'

There is an ancient rule which says that if a computer can read a program, it can write it back out again. In the case of 'Haunted Abbey' however, the new game from A&F Software, it will probably take many working hours to break into the protection and make yourself a back up copy. This is ths latest in anti piracy moves being made by all software houses and especially the members of GOSH (The Guild of Software Houses), both individually and as a group.

Jim Lamont, whose anti piracy system was confiscated by the Ministry of Defence earlier this year, has offered an alternative system to a number of software houses and A&F have come up with the software to make it work. The system makes it impossible even to make audio copies. The method used employs two stages, one at the software stage, the other at the duplication stage. A&F believe that the huge pirate operations now going on up and down the country will go out of business and that the consumer will eventually benefit fom lower prices for legitimate software as numbers sold, rather than copied, increase.

The Lamont system is also

CONTINUED OVER

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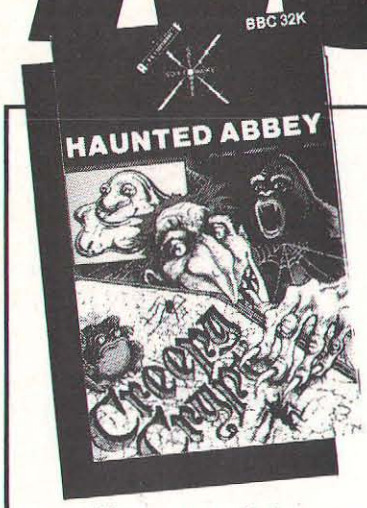


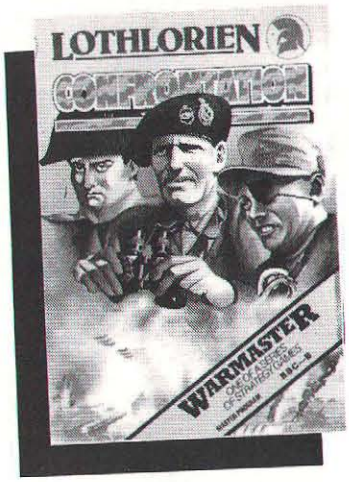
covered by a patent which means that the patent laws (much stronger than copyright) can be invoked in the unlikely event that any pirates succeed in cracking the system. Only four men worked on the final stages of development and no one person could make the system work. A&F are considering what to do with the system they have developed first among the software houses. It may well turn out that they give the system over to other companies they can trust. A&F claim that this sort of protection means that the smaller software house will be able to survive the destructive influence of piracy. This will of course only be true if the smaller companies have access to the system on an equal footing.

Meanwhile Mr Lamont is pledging to use the money won in any court cases againat pirates to further the anti piracy campaign. Poor old 'Haunted Abbey' looks to be eclipsed by the protection it carries. It is a classic adventure in which puzzles and red herrings hinder the quest for Phibe's book of incantations and the treasure which lies in the abbey.

FIGHT IT OUT WITH LOTHLORIEN

Confrontation is the latest in the Lothlorien Warmaster series, which brings the smell of battle to the BBC. Confrontation appropriately brings together two players to battle it out in a user defined scenario. The master program allows the players to choose geographical features and the forces to take part. A modern European scenario is provided for those who want to dive straight into battle.

Various units of armour, artillery, infantry, airbourne troops and air support are brought to bear by both sides as the computer commanders shift resources around the terrain trying to outwit their opponents. Lothlorien intend to follow up the program with the release of a number of scenarios incorporating the fairly modern weapon systems available in the game, thus expanding the value of owning the master program. In fact Lothlorien are quite happy to hear from enthusiastic players



who have designed their own scenarios with the Confrontation software with a view to publishing them. That's what I call incentive.

MORE FOR MICRONET

Micronet Users now have free access to both their own 800 club's 30,000 pages and Prestel's new spot "Prestel Microcomputing". Prestel is of course open to use by Micronet subscribers in all its various forms.

Prestel Microcomputing will in fact embrace all microcomputing services on the system, including Micronet itself, Clubspot, and Viewfax. The reorganisation of the database removes obstacles to further expansion, including 'School Link', a dedicated information and software database for secondary schools (begins September), 'Headstart', home education software, and 'Executive Micronet' starting in June.

Initially the only apparent change will be the opening page stating 'Prestel Microcomputing incorporating Micronet 800' with an increasingly extensive menu. Information about the network from Micronet at Scriptor Court, 155 Farringdon Road, London, EC1R 3AD. Tel: 01 278 3143.

GIVE US A CLUE

Level 9 Computing are extending their adventure help service which has always been available to anguished adventurers to include comprehensive clue sheets for all the company's adventures

The idea was originally tried out with Colossal Adventure and the response from adventureres was 'why not more of the same for other games' The clue sheets do not assume that the puzzle or clue which the designer considered hardest in fact proved so. Many experienced players get blind spots and can get stuck on supposedly simple puzzles.

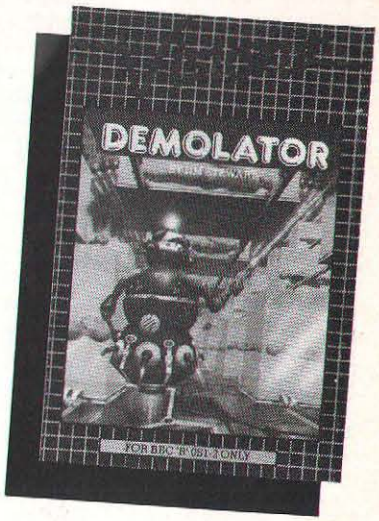
The Level 9 clue sheets contain alphabetical lists of objects, creatures and trickiest locations in each adventure. They contain up to 580 entries so the problem you have encountered should be there and the format means that you will not accidently learn of puzzles to come.

Clue sheets are available to all Level 9 adventurers who send a SAE to Level 9 Computing, 229 Hughenden Road, High Wycombe, Bucks. HP13 5PG.

GET READY TO DEMOLATE

Xeno, the ultimate robot, is mankind's last chance in Vision's latest game for the Model B. The last remnants of the human race are being transported (just so many packing cases) across the galaxy. The hold of the ship has been invaded by the Demolaters. Can Xeno fend them off and preserve the dormant human cargo?

This game features some very fast and pretty smooth sideways scrolling as Xeno dashes about all over the cargo bay picking up points as it vapourises the Demolators themselves, and their deadly companions, including the Minors, briefly vulnerable but



mutating into a deadly indesctructible mines.

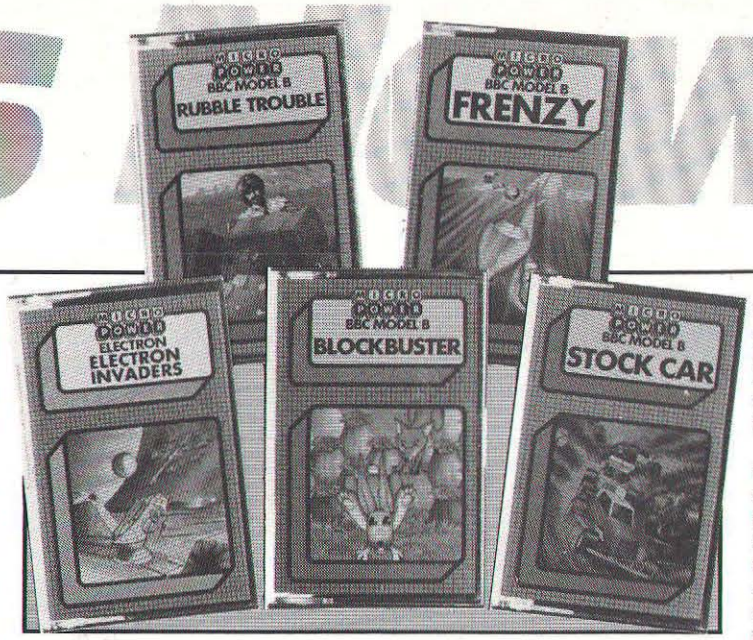
The Protectors and Trackors appear to provide even more formidable enemies later in the action and Xeno is hard pushed to complete his task. Demolator by Jim Stewart is priced at £6.95.

BRAINCHILD BRINGS TOGETHER BBC AND IBM PC

The Computer Fair at Earls Court in mid June witnessed the launch of Data Technologies IBM P.C. compatible upgrade for the Model B. The Cambridge hothouse continues to produce revolutionary products to support the BBC and this one is particularly well branded as the 'Graduate'.

It's based on Microsoft's MS-DOS operating system and comes at a time when Torch are also moving into MS-DOS territory (see Torch Rekindled). Two models of the Graduate are available, the Model G400 and G800. Both have 12K RAM as

NEWS NEWS



standard and are fully disc compatible with the IBM P.C. thereby giving access to the massive store of IBM compatible software produced by leading software houses. Does this mean Microsoft's Flight Simulator on the Beeb?

The G400 incorporates a single BASF disc drive and for users requiring further storage there is the dual drive G800 complete with the full suite of Perfect 2 software (colour). Both models are further expandable in the same way as the IBM, allowing hard disc expansion, modems, mouse cards etc..

The single drive version costs £599 and twin drive with software £869, both excluding VAT. The availability of the Graduate offers an interesting alternative to the Torch and Acorn CP/M upgrades and means a low cost introduction to IBM software for education and industry. Details from Data Technologies Ltd., Century House, Market Street, Swavesey, Cambridge CB4 5QG. Data Technologies managing director, Martin Vlieland Boddy, is the ex chairman of Torch and believes that the MS-DOS system is the one to follow because of the great success of the IBM P.C.. BBC owners can only wonder at the vast range of choice now made available to anyone wanting to upgrade their humble 32K Micro and at how cheap at least in relative terms it is becoming.

MICRO IMPACT

Micro Power are dropping their Program Power name. There is no doubt that the two names have caused confusion in the minds of software buyers over the past year or so despite the fact that the Micro Power games have become some of the best loved amongst BBC Micro owners. Many of these games are now available on the Electron and there is soon to be a range for the Commodore 64.

At the same time a new batch of BBC and Electron software is released by the Leeds based software house. For the Beeb there are Frenzy, Stock Car, Blockbuster and Rubble Trouble. The Electron is treated to its very own specialist invaders game, Electron Invaders. Players have to leave the safety of the bunkers to fire at the Delerian attack force flying overhead. There is the traditional mothership but watch out for shrapnel from the exploding bombs.

Stock car offers a multitude of options for the player to decide upon before tackling any one of the six circuits in a typically robust stock car, crashing into barriers, clashing with other cars (including a computer controlled opponent if you want). It is essentially a two player game however with joystick option.

Blockbuster brings us Harvey Rabbit, Reynard the Fox, squirrels and an irate albatross. The action all takes place on the Giant's Causeway, rock to rock. Rubble Trouble continues the stoney theme, this time is a desolate post holocaust wasteland (lovely I'm sure). Watch out for the mutant Krackats as they scavenge for food amongst the rotting ruins. All the new Micro Power games (some ironically still with Program Power welcome screens) cost £7.95.

IBM LINK

Acorn Computers are further diversifying their research and development interests with a stake in another Cambridge based company, Torus Systems Ltd., Torus are launching their first product, called Icon, a graphics-contolled local area network for the IBM P.C..

The product integrates communications (such as electronic mail, Prestel and telephone dialling), networking facilities and exisiting applications software in a coherent user-friendly office automation system. Torus' skills in communications software will combine with Torch and Acorn expertise to form a particularly powerful force. Torus Systems is located in the Cambridge Science Park which will no doubt bear fruit for Acorn's future projects.

MUSICAL BBC GOES MIDI

Electromusic Research has produced the first MIDI interface for the BBC Model B, allowing connection with any MIDI equipped musical instrument. A software package available on cassette or disc allows full MIDI control to and from the micro. The package includes the necessary cables and external synchronisation plus start/stop is easily achieved by using the standard Roland/Korg 5-pin DIN Sync input provided.

MIDI is a standard interface employed by the music industry in much the same way as the RS232 is used amongst computer manufacturers.

The key to success in this field is likely to be the availability of quality easy to use software and ELEctromusic Research are launching the product with their Miditrack Composer and promise a developing range of programs for the Beeb.

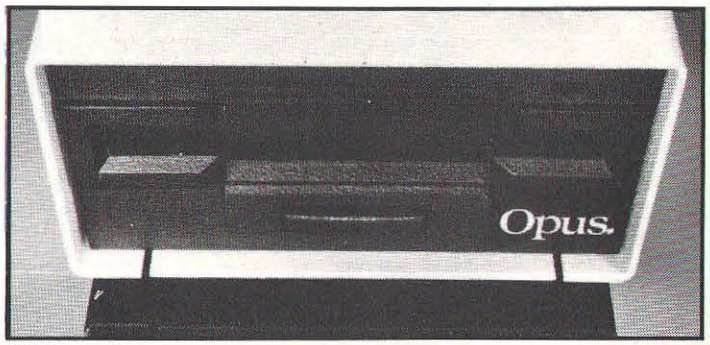
Miditrack Composer provides for manual (step) input over six possible tracks with full memory assignment of approximately 7000 notes. Each track will store details of note pitch, dynamics, length and style as well as voice change and other parameters, such as aftertouch, portamento and modulation (subject to the equipment your BBC is connected to).

Completed compositions may be saved to tape or disc for later recall along with MIDI configuration parameters and tempo. Any combination of the 16 track and 4 channel mode assignments available through MIDI can be selected to control up to six MIDI equipment instruments. MIDI OUT also transmits a 'down-line' timing control for MIDI drum machines and sequencers. So if you want a BBC driven synthesiser group in your lounge, you know what to do!

The BBC MIDI interface plus Miditrack Composer on cassette or disc is available at around the £130 mark from Electromusic Research, 14 Mount Close, Wickford, Essex SS11 8HG. Tel: 03744 67221.

MORE MICRO-SIZE DRIVES

Opus Supplies now have their version of the 3" drive available in single or dual drive form and capable of supporting double



3" Opus drives

CONTINUED OVER

News News

density discs. The single drive will cost you £299.95, the dual £495.95. Both include all necessary cables and utilities disc. The 'cartridges' retail at £5.75 or £25.95 for a pack of five.

SCRUTINISE YOUR LOGIC

The BBC model B can now link up with an add-on unit from Hawk Electronic Test Equipment to carry out complex logic analysis. The Hawk Model 3210S is controlled from the BBC's keyboard, providing 32 TTL or variable threshold input channels. The software utilises disc, monitor and printer to record and display 16 or 32 channels of data. Once data has been recorded on disc it can be processed by the computer as the user requires.

Each channel captures 1024 samples timed by an internal clock to 10MHz or by an external clock. There is flexible control of triggers, and the software is easy to use with full menu driven operation, on screen prompts and 'help' page. Further information from Hawk Electronic Test Equipment, Bircholt Park Ind. Estate, Maidstone, Kent ME15 9XT.

Hawk Logic Analyser

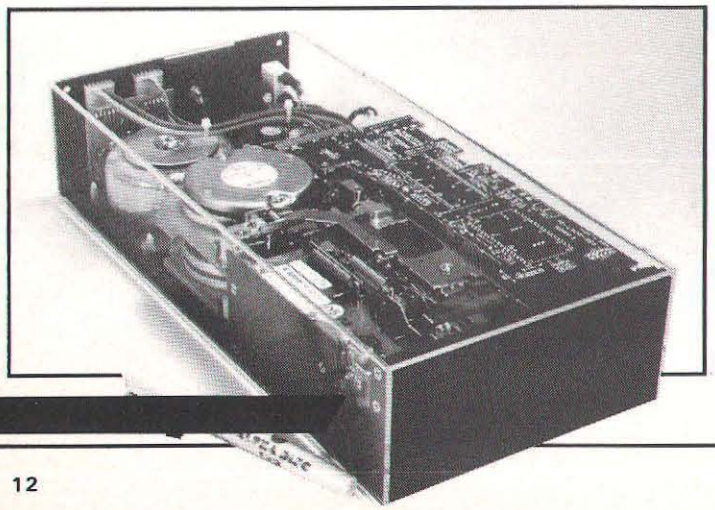
ALPHA PLUS

An improved version of the Canon MDD221 disc drive has been designed by Alpha Disc Ltd, for use in the home or educational set up. Alpha's enhanced version with a 40 or 80 track LED indicator and secondary switched power supply is now available at a starting price of £244.

The Canon's 40 to 80 track power reset facility has now been given a four-signal switching code which makes the status of the drive obvious to even the newest user. The model which also includes its own secondary switching power costs £264 and offers a safer and less 'hot' system. Information from Alpha disc Ltd, Uni 2, Crabtree Road, Thorpe Industrial Estate, Egham, Surrey.

1MB FOR 3" DISC

It shouldn't be long before a one-megabyte version of the 3" compact floppy disc format finds its way into BBC Micro systems. Hitachi Maxell have developed a new magnetic disc to meet the highly accurate head positioning requirements of the 200 tracks per inch density. The new format provides 500 kilobytes of unformatted recording capacity per side.



UNIX UNLEASHED

Torch Computers claim to be selling at least 30 of their Unicorn systems for the BBC Micro each month. Small colleges and university departments who already own Model Bs are taking the natural step into UNIX via the Unicorn 68000 box with UNIX System III. For under £3,000 the Unicorn also provides the user with 20 Megabyte hard disc, networking and 256K RAM.

Also supplied is the Z80B which runs CP/M programs on UNIX systems allowing new users to continue with old software.

SUPER SPRITES FOR ELECTRON

Simonsoft's package 'Sprites Version Two' is now available for the Electron. The creators claim a 14-fold increase in speed over normal methods of animation in BBC BASIC.

All the features of the BBC version are incorporated including generator programs for user-designed sprites, enlargement of up to five times the normal sprite size, a collision detector, preset flight paths and up to 48 sprites on screen at any one time. Each sprite can have a second image for individual animation and the program has its own sprite library. The Electron, with its slightly slower speed when it comes to handling graphics should feel the benefit of such a utility. Details from Simonsoft, 25 Tatam Road, Abingdon, Oxon. OX14 1QB. Tel: 0236 24140.

I SPY2

SPY2, the latest version of System Software's debugging monitor, disassembler and disc utility ROM, is now available.

SPY2 has some additional front panel commands, a new set of disc recover utilities, a formatter, relocator, program trace and a versatile disassembler. The latter incorporates the ability to inspect, single step through or disassemble any ROM, single step through subroutines (each treated as a step). There is also a colour/black and white option for the display.

The disc utilities are pretty comprehensive and rival even Computer Concepts Disc Doctor ROM. SPY2 includes a disc sector editor with hex and ASCII display, recover and format bad track (sounds interesting), find string or hexcode on disc catalogue entry and download and run disc file.

The complete SPY2 package is available from SYSTEM Software, Dept.B, 12 Collegiate Crescent, Sheffield S10 2BA.

Eprom Programmer for the BBC Micro

This compact, elegant unit programs 2764 & 27128 eproms and offers the following attractive features.

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Programmer and data sheet from Softlife Ltd., 87 Silvertown Way, London E16 4AH Tel: 01 474 0330

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NIKAM 6502 MICRO CONTROLLER

A Star product which enables programs developed on the BBC Assembler to be downloaded via the RS423 Port and blown onto EPROM. The Micro Controller will then autostart on power up to perform as a dedicated Stand Alone unit.

Applications include Robotics, Data Logging, Timing, Machine Control, Speech & Sound Synthesis etc.

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Notemaster

Alec Bray

Play the part of writer and producer with this powerful music utility.

Have you ever wonder what a tune would sound like if you could play it backwards — or turn it "upside-down" — or even if you could play it "upside-down" and backwards? Some pieces of music use such tricks, and this program will allow you to investigate these "variations"! But more than this, you will be able during the course of the program to see each note of the tune shown in three ways — as the musical name (C, C#, D etc), as a key on a piano keyboard, and as a note of the correct pitch and duration (eg quaver, crotchet, etc) displayed on a stave (the five lines used in music notation.)

The main part of the program was originally written as a demonstration to show information stored in arrays could be variously manipulated: sound was used because of its immediate impact. The information on note frequency and note duration could be altered independently and the arrays could be read in various ways. Since a keyboard and stave were required for other purposes, this initial sound program was used as a "mobile text-bed". As a result, the program may be mathematical rather than musical, and naturally the program structure leaves something to be desired, but the results to date have proved interesting, informative and entertaining, and you may well find that some of the procedues will fit easily into further programs!

However, please beware! If you type in this progam, you must use no additional spaces: use spaces only where required by BASIC (as in front of OR): and use the line numbering as given (starting at 1, counting in 1's). There is very little memory left to play with when the program is running. This will serve to explain the use of multistatement lines and the lack of REMs. I know that it makes the program difficult to follow, and difficult to document properly (and there are a number of ways that the program could be improved!) but this article and listing was prepared from repeatedly successful runs of the program.

RUNNING DESCRIPTION

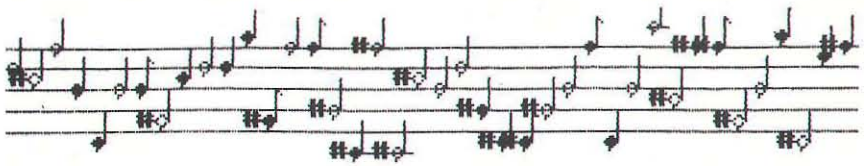
Perhaps it is best to describe the features of the program as if it were running! The title page shows a brief message, and plays a random tune, displaying the notes correctly on the stave. The duration of the note is indicated by printing a quaver, crotchet, mimim or semibreve, and the note can be sharp or natural: sharps are indicated by the sharp sign in front of the note. Only sharps are identified — B flat is written as A sharp. If you think that the title is too tedious, try altering line 145: change FOR TLE = 1 TO 40 to FOR TLE = 1 TO 10 for example! Because the title page uses some of the procedures called later in the program, some variables are necessarily set during the title routine. Following the title, all the other variables are set.

Now you are ready to play your tune! Firstly, a piano style keyboard is displayed on the lower half of the screen. The letters on the computer's keyboard appear under the notes of the scale of C, to provide some cues, but you can play the sharps by using keys on the "number" row and "ASDF" row as well (some keys will not, purposely, respond). As you play your tune, the name of the note is printed on the screen (ie C E F G). The correct note on the piano keyboard is arrowed.

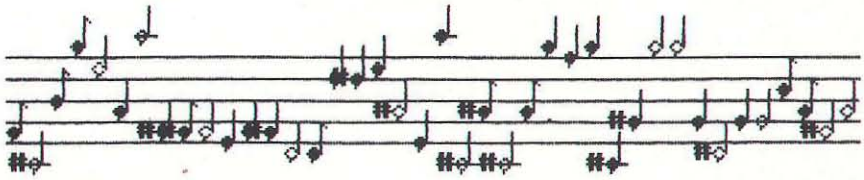
The keyboard is drawn by means of an algorithm based purely on the particular size of keyboard chosen. The black notes are drawn by a simple loop that draws black vertical lines either side of the line that separates the white notes — but what is needed is a method of preventing this loop being activated at the junction of the notes B and C, and at the junction of the notes E and F. It is this "problem" in music — that notes go up in tones except between B/C and E/F — that makes the drawing of the keyboard, the moving of a pointer, and the printer of a note on the stave all so complicated!

For this particular size of keyboard, the numbers to be skipped fall into two distinct sets: one, the numbers 330, 610, 890, and 1170 reduces quite nicely to 10 * (N * 33 — (N—1) * 5) for increasing values of N: the other, 170, 450, 730 and 1010 is a little more tricky. The same algorithm will not work, since the multiple for the 5 is different to the multiple for 33 (or whatever). If you start multiplying the number 11 by a multiple, and increment that multiple by 3 each time, you need the set 2, 5, 8, 11: but the 5 needs to be multiplied by 1, 2, 3, 4 in turn. The solution is to take the integral of the number from the first set after division by 3 — and then add one to this. This second algorithm becomes 10 * (M * 11 — (INT (M/3 + 1) * 5).
N and M have different initial values and increment in different steps. This is only useful for multiples of this size of keyboard!

As each key is pressed, the correct piano key is indicated. The centre of each note (black and white) are 20 units apart — except, that is, between every B/C and E/F when they are 40 units apart! It gets complicated! PROCNOTE takes the note frequency value, and finds how many B to C and E to F junctions there are *below* the note to be pointed to — and for every such junction it increments the pointer dummy variable by one. Luckily enough, this particular routine is reasonably easy — from the starting notes of frequency value 117

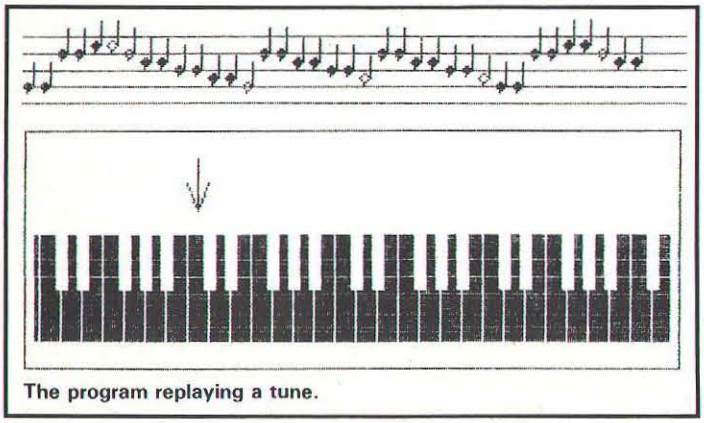


Notes displayed on the stave.



Title tune.

Entering a new tune.



The program replaying a tune.

INPUT M%	M%=INT..	METRONOME
30	35	34
31	34	35
32	34	35
33	33	36
34	33	36
35	32	37
36	32	37
37	31	38
38	31	38
39	30	40
40	30	40
41	29	41
42	29	41
43	28	42
44	28	42
45	27	44
46	27	44
47	26	46
48	26	46
49	25	48
50	25	48
51	24	49
52	24	49
53	23	52
54	23	52
55	22	54
56	22	54
57	21	57
58	21	57
59	20	60
60	20	60
61	19	63
62	19	63
63	18	66
64	18	66
65	17	70
66	17	70
67	16	75
68	16	75
69	15	80
70	15	80

Required metronome setting (INPUT) and actual metronome speed (third column).

and 145 (as far as the BBC computer is concerned!) this extra jump must be included every 12 semitones, ie. every extra 48 added to those starting values. (ie. check for frequency being greater than 117 + 48 * I or greater than 145 + 48 * I). This dummy variable X%, suitably incremented, is passed to PROC-POINT, the procedure which draws the arrow. This procedure draws the last arrow in black, draws the new one in white, and holds this current arrow position in an integer store.

On pressing / RETURN / or reaching a 40th note, the "tune-entering" phase is complete. The limit on the number of notes is two-fold: firstly, this is the maximum number of notes that can be printed on the stave as used in the program; secondly, there is no memory available for larger arrays.

MAIN LOOP

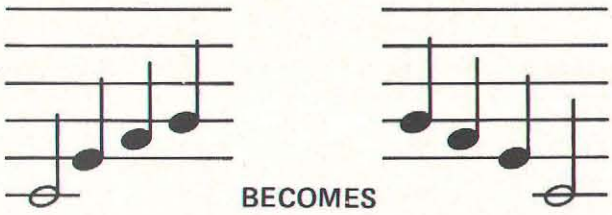
The main program loop is now entered. The main program is only some thirteen lines long. These first thirteen lines indicate the main structure of the whole program. Within the loop, the menu is first presented: pressing 9 exits from the program, pressing 0 allows another tune to be entered.

Pressing 1 from the menu replays the tune that has been entered. Besides pointing to the key on the keyboard, the notes are printed on the stave, as in the title. If, however, a note is beyond the range that can be shown on this stave (treble clef, C is C above middle C), a message "off this stave" is printed — and each time, hopefully, in a different colour! This message may not be terribly useful, but within the constraints of position is determined by the number of the note in the tune: since 32 units are allowed for each note, 32 * TUNE gives the horizontal position. If the sharp flag is set, a sharp sign is printed and the flag cleared.

The duration of the note has to be checked, too. A reference value is used (M%) which is set at the beginning, but can be altered. The duration of each note is compared to a multiple of this reference value, the correct one of four note lengths being printed at the graphics cursor. For the notes used, only 5 separate character redefinitions are needed — 2 for the tops and three for the bottoms. Beware, however! Because the duration of the notes are checked using a simple greater than/less than routine, two notes which seem to be of the same duration may be printed differently, one falling one side of the inequality, and one the other. Within limits it works quite well. There are no faster notes — memory again, for one thing!

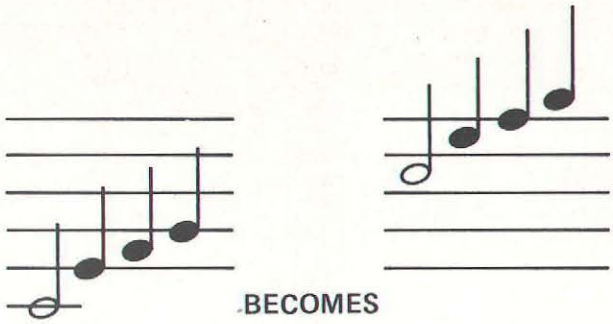
You will have noticed that the colour of the keyboard surround has altered to a flashing magenta/green: this is to provide some form of constant "metronome" effect — a reference with which to compare the printed notes and the note duration. If you find this irritating rather than useful omit

CONTINUED OVER



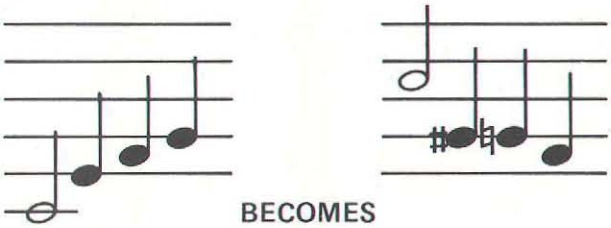
BECOMES

THE TUNE PLAYED BACKWARDS



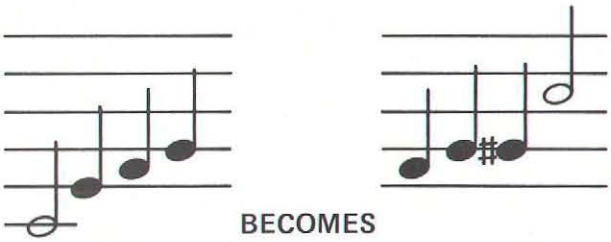
BECOMES

THE TUNE TRANSPOSED ONE OCTAVE (12 SEMITONES)



BECOMES

THE TUNE TURNED 'UPSIDE-DOWN'



BECOMES

THE TUNE TURNED 'UPSIDE-DOWN' AND THEN PLAYED BACKWARDS

line 17: this will also mean that you can alter the parameter passed to PROCSTAVE to 1 if needed. The stave would then be drawn in red which might be more restful!

On playing the tune backwards, the program works in a similar way, except that the arrays are aread in the reverse direction: to maintain the notes' correct position horizontally on the stave we need a dummy variable to count forward as the array works backwards. BKW = N% — TUNE + 1.

The first time that you TRANSPOSE on each run, you will get a short reminder message about it. It's very irritating when you are familiar with a program to be faced with the same instructions time after time, but sometimes a reminder is useful. In this program, both TRANSPOSE and UPSIDE-DOWN use a variable "flag" to indicate whether they have been used already — if they have not been used, you get a message, but thereafter the message is suppressed. Transpose allows you to select up or down, and GETs 1 — 9 semitones. (for an octave do it twice : 9 then reselect and do 3). Transpose loops around, adding +4 or −4 to every note in the array NO(TUNE) — but to avoid 'losing' notes those which are at the extreme edges of the range appear at the other end of the range — a note going above 253 becomes 17, for example. Hence the tune may suddenly seem strange if you transpose too far! Since each transposition is stored in the main array, it is this new version of the tune which is used for further manipulations.

PLAY IT ON YOUR HEAD

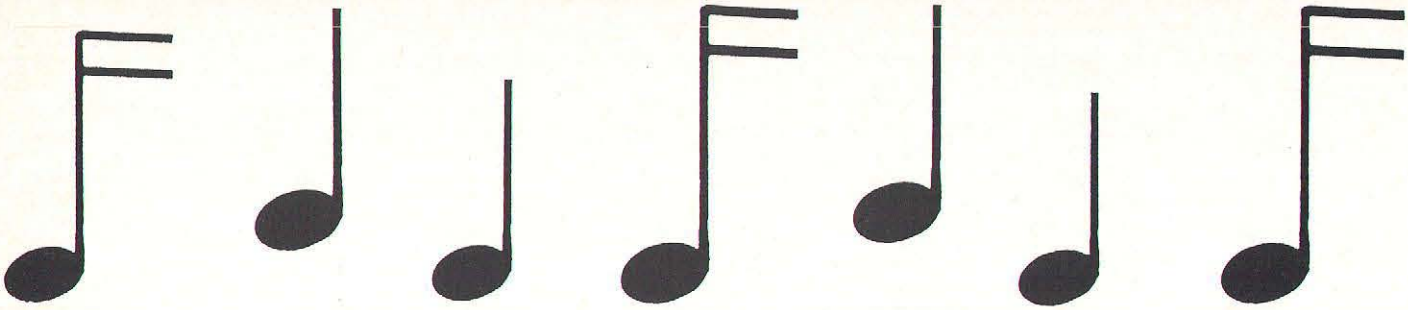
Turning the tune UPSIDE DOWN is more mathematical than musical: it's not a proper inversion, although the mathematical function is a self-inverse! (x 250 — x). The new value is stored in the array INV(TUNE) (rather than being repeatedly recalculated from the main array). This will allow comparison of the tune turned upside down, and the tune transposed. (or transposed and played backwards!) And, of course, you can read from the array INV(TUNE) in the reverse direction.

PROCSPEED manipulates the stored information in one of two ways. If you want the tune to simply play faster, every note has its duration halved: for a slower tune, each element of the array DUR(TUNE) is doubled. These new durations affect all possible future choices. You will probably want to alter these speed settings to get the best of the various envelopes: also, you can enter a tune in slowly, and play it back faster. In music there is no preset duration for each musical note — a crotchet may vary considerably in its duration from piece to piece. A fast piece of music could be written in "slow" notes, the musician being told to play fast. PROCSPEED allows this, by resetting the reference value for note duration comparison, M%. It's called "Metronome", but it is not strictly so: the routine used is very simple, and works within the limits 30 to 70 with a maximum error of some 15%, which given the inequality comparison for duration seems to be satisfactory: outside this range the error is large. Setting the metronome at 50 should give you 50 crotchets a minute. (default value is 72). Again, this is more an example of how information can be manipulated!

There are four contrasting envelopes available: envelope 4 sounds more interesting on slow tunes, envelope 2 copes better with quick tunes.

You will notice that there are two text windows established: one used for the title (in line 141) and the other for use in the rest of the program (in line 16). These enable text to be scrolled without affecting the graphics display, and it means that some text is printed at the graphics cursor, using VDU5 and VDU4 commands: when interrupting the program, the text may print where you don't expect it to. A futher point is that the autorepeat facility is disabled in this program, which will make the editing of lines a little more difficult!

There are a number of ways that the program could be developed — by the addition of bar lines (count the duration of successive notes), dotted notes, an additional stave, sideways scrolling, the editing out of any wrong notes. The major problem is one of memory — removing INV(TUNE) and its procedures would allow these other ideas, but would lose sight of the purpose of this program — to show how information, in this case sounds, can be messed about with! As an exampler, try C E F G — that's "Oh when the saints . . .". Turn it upside down — you should get a hint of Tchaikovsky's piano



concerto . . .

The program was written on a 32K machine with a 0.1 operating system, and it has run on a machine with a 1.2 operating system.

You may find this program has some features which can be used in further programs — particularly the BASIC routines to draw the keyboard and its arrow, and the notes on the stave. I hope that they are 'accessible' and make sense: I enjoy watching the arrow point to all the piano notes! And with a high resolution screen dump routine — you can enjoy writing music!

VARIABLES USED

Flag Variables

A%	Initially 0, this flag is set to 1 when 'upside down' is used for the first time.
B%	Initially 0, this flag is set to 1 when transposition is used for the first time.
SH%	This is set to 1 every time that a sharp sign is to appear in front of a note on the stave. It is then reset to 0.

Array Variables

DUR(TUNE)	The duration of the note.
INV(TUNE)	The value of a note found by 250-NO(TUNE), but stored in an array to allow transposition of original.
NO(TUNE)	The numerical value of the particular note. TUNE is the counting variable.

Integer Variables

ARR%	Used to plot the horizontal coordinate of the keyboard pointer.
CL%	Parameter used to define the colour of the additional lines of the stave for C and A.
E%	The number of the envelope in current use: used in a number of procedures.
K%	Derived from the numerical value of the note, this is used to determine whether a note is sharp or natural (setting flag SH%), and then is used to print the note in the correct position vertically on the stave.
M%	The reference value against which the duration of the notes are compared, to draw the correct type on the stave.
N%	The number of notes in the tune (maximum value = 39).
NT%	Equivalent to the value of NO(TUNE), used to pass the value of NO(TUNE) into the various procedures (when array was passed the results were not appropriate).
R%	A random note value, used in the title sequence.
X%	Intermediate variable used to define the position of the keyboard pointer.
XOLD%	Intermediate variable used to define the previous position of the keyboard pointer.

Response Variables:

R	Response to menu (−1 * (48 − Y))
SEMI	Number of semitones
Y	General numerical response variable.
A$	Key press for note.
Y$	General response variable.

Other Variables:

BKW	Used to determine the horizontal position at which to print a note on the stave when the array is rea in the reverse direction.
D	Equivalent to DUR(TUNE) to avoid passing an array into a procedure: array read in reverse direction within procedure.
I,J	Loop variables.
L	The duration (using TIME) between keypresses when entering a tune.
N	Used to record the starting TIME of a particular note: TIME-N = L.
RAN	A random number (1 — 3) used to print a message — a new colour indicates that the message is repeated.
TLE	Used in the title sequence to print a note in the correct horizontal position along the stave.
TM	Used in the timing loop, the purpose of which is to force the BASIC to wait for the sound channel to complete the note.
MES$	String variable: read data for on-screen messages and display.

A number of other variables are used, for instance in the passing of parameters into procedures.

PROCEDURES USED

PROCBACKINVERT	Reads the array INV(TUNE) in the reverse order, and plays the note. Calls PROCNOTE, PROCQVR.
PROCBACKWARDS	Reads the array NO(TUNE) in the reverse order, and plays the note. Calls PROCNOTE, PROCQVR.
PROCINIT	Initialises all variables except those used in the title sequence, dimensions the arrays, sets flashing colour to logical colour 1.
PROCINST	Allows the choice of 4 possible envelopes.
PROCINVERT	Turns the tune 'upside down' by subtracting each original note value from 250. This is stored in an array INV(TUNE) to permit the original tune to be transposed without altering the 'upside down' values. On first use on each run a message is displayed.
PROCKEYBOARD	This draws the keyboard within a graphics window
PROCMENU	This procedure presents the options available to the user (clearing part of the displayed graphics.)
PROCNOTE	Sets up the dummy variables used to point to a particular note in the keyboard. Calls PROCPOINT
PROCPLAYINVERT	Reads from the array INV(TUNE) to play the upside-down version of the original tune. Calls PROCNOTE, PROCQVR.
PROCPOINT	Determines whether a note can be shown on the keyboard, and if possible, draws an arrow to point to the particular note.
PROCQVR	Determines whether a note can be printed on the stave. If it can be printed, then the length of the note is compared with multiples of the reference length-of-note to determine what type of note to draw, and then prints the note in correct vertical position on the stave.
PROCREPLAY	Replays the tune in the same form as it was entered, but shows the notes in correct posi-

CONTINUED OVER

tion on the stave as well as pointing to the correct piano key. Calls PROCNOTE, PROCQVR.

PROCSPEED — Either alters the reference value for length-of-note display, or allows the complete tune to be played faster or slower by a factor of 2: new note lengths are stored in DUR(TUNE).

PROCSTAVE — Draws the stave.

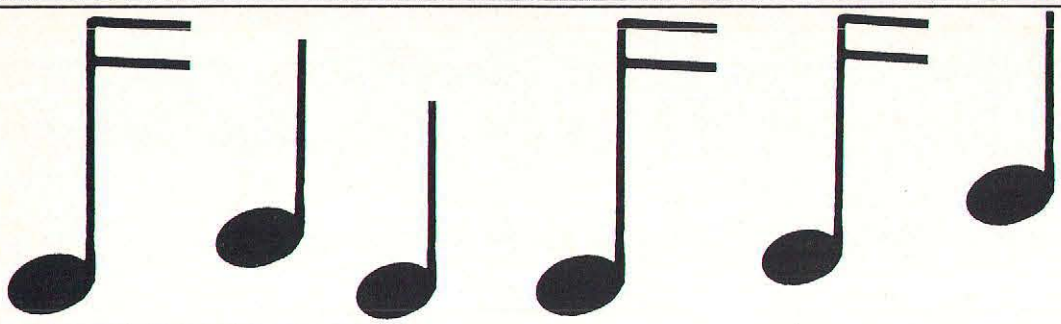
PROCTRANSPOSE — This will transpose the complete tune up or down by up to a maximum of 9 semitones at a time: to transpose a complete octave use 6+6 or 9+3 ! The transposed tune now forms the contents of the array NO(TUNE), and is used as the basis for further alterations etc.

PROCTITLE — This sets up the title page consisting of a stave and brief message: a random tune is then played. To do this, some variables are set as part of the title.

PROCTUNE — This procedure accepts valid keypresses and converts them into numerical values to pass to the sound channel. The appropriate note is 'sounded' briefly (using whichever envelope is selected). The numerical value is stored in the array (NO(TUNE)). The duration between one key press and the next is calculated: this is stored in another array (DUR(TUNE)), for use on replay. The musical letter C,D,E,F etc for the note is displayed on the screen.

PROGRAM LISTING

```
   1MODE1:PROCTITLE:PROCINIT:PROCTUNE:REM*A.P.BRAY*
   2REPEAT
   3PROCMENU
   4IFR=0THENPROCTUNE
   5IFR=1THENPROCREPLAY
   6IFR=2THENPROCBACKWARDS
   7IFR=3THENPROCTRANSPOSE
   8IFR=4THENPROCSPEED
   9IFR=5THENPROCINVERT
  10IFR=6THENPROCPLAYINVERT
  11IFR=7THENPROCBACKINVERT
  12IFR=8THENPROCINST
  13UNTILR=9:END
  14DEFPROCINIT
  15CLS:DIMNO(40):DIMDUR(40):DIMINV(40)
  16FORI=1TO40:NO(I)=0:DUR(I)=0:INV(I)=0:NEXT:TUNE=0:P
ROCKEYBOARD:VDU28,0,15,39,0:E%=1:*FX11,0
  17VDU19,1,13,0,0,0
  18ENVELOPE1,1,0,0,0,0,0,0,0,2,0,-10,-5,120,0:ENVELOPE2
,3,0,0,0,0,0,0,0,121,-10,-5,-2,120,120:ENVELOPE3,7,2,1,1,
1,1,1,121,-10,-5,-2,120,120
  19ENVELOPE4,1,1,1,0,0,1,1,61,0,-10,-120,120,120:A%=0
:B%=0:SH%=0:ENDPROC
  20DEFPROCMENU
  21GCOL0,0:MOVE25,350:DRAW25,450:PLOT85,1250,450:DRAW
1250,350:PLOT85,25,350:MOVE0,0:DRAW0,38:PLOT85,1280,38:
DRAW1280,0:PLOT85,0,0:GCOL0,3
  22CLS:COLOUR2:PRINT''"T H I N G S  Y O U  C A N  D O
 :":COLOUR1:PRINT'"PLEASE ENTER ONE OF THESE NUMBERS"
  23COLOUR3:PRINT'" NEW  TUNE          0"
  24PRINT" PLAY  TUNE          1":PRINT" BACKWARDS
 2":PRINT" TRANSPOSE          3":PRINT" CHANGE SPEED
4":PRINT" UPSIDE DOWN        5"
  25PRINT" PLAY ";:COLOUR2:PRINT"UP/DOWN";::COLOUR3:PR
INT"      6":COLOUR2:PRINT" BACKWDS/UPDOWN";:COLOUR3:PRI
NT"   7":PRINT" NEW INSTRUMENT   8":PRINT" EXIT FROM PR
OG   9"
  26Y=GET:IFY<48ORY>57THEN26
  27R=-1*(48-Y):PRINTR:ENDPROC
  28DEFPROCTUNE
  29CLS:PRINT''"  PLAY YOUR TUNE NOW !":PRINT"  ******
**************"
  30COLOUR2:PRINT'"  type  [RETURN]  to end tune":COLO
UR3:PRINT'
  31VDU5:RESTORE77:GCOL0,3:FORI=1TO19:READN$:MOVE20+I*
40,30:PRINTN$:NEXTI:VDU4
  32*FX15,0
  33TUNE=0:N=TIME
  34REPEAT
  35TUNE=TUNE+1
  36A$=GET$:L=TIME-N:N=TIME:DUR(TUNE-1)=L/5:IFASC(A$)=
13THEN75
  37IFA$="1" ORA$="4" ORA$="8" ORA$="A" ORA$="G" ORA$=
"K" THEN36
  38IFA$="Q"THENNO(TUNE)=101:PRINT"C   ";
  39IFA$="2"THENNO(TUNE)=105:PRINT"C#  ";
  40IFA$="W"THENNO(TUNE)=109:PRINT"D   ";
  41IFA$="3"THENNO(TUNE)=113:PRINT"D#  ";
  42IFA$="E"THENNO(TUNE)=117:PRINT"E   ";
  43IFA$="R"THENNO(TUNE)=121:PRINT"F   ";
  44IFA$="5"THENNO(TUNE)=125:PRINT"F#  ";
  45IFA$="T"THENNO(TUNE)=129:PRINT"G   ";
  46IFA$="6"THENNO(TUNE)=133:PRINT"G#  ";
  47IFA$="Y"THENNO(TUNE)=137:PRINT"A   ";
  48IFA$="7"THENNO(TUNE)=141:PRINT"A#  ";
  49IFA$="U"THENNO(TUNE)=145:PRINT"B   ";
  50IFA$="I"THENNO(TUNE)=149:PRINT"C'  ";
  51IFA$="9"THENNO(TUNE)=153:PRINT"C#' ";
  52IFA$="O"THENNO(TUNE)=157:PRINT"D'  ";
  53IFA$="0"THENNO(TUNE)=161:PRINT"D#' ";
  54IFA$="P"THENNO(TUNE)=165:PRINT"E'  ";
  55IFA$="Z"THENNO(TUNE)=169:PRINT"F'  ";
  56IFA$="S"THENNO(TUNE)=173:PRINT"F#' ";
  57IFA$="X"THENNO(TUNE)=177:PRINT"G'  ";
  58IFA$="D"THENNO(TUNE)=181:PRINT"G#' ";
  59IFA$="C"THENNO(TUNE)=185:PRINT"A'  ";
  60IFA$="F"THENNO(TUNE)=189:PRINT"A#' ";
  61IFA$="V"THENNO(TUNE)=193:PRINT"B'  ";
  62IFA$="B"THENNO(TUNE)=197:PRINT"C'' ";
  63IFA$="H"THENNO(TUNE)=201:PRINT"C#''";
  64IFA$="N"THENNO(TUNE)=205:PRINT"D'' ";
  65IFA$="J"THENNO(TUNE)=209:PRINT"D#''";
  66IFA$="M"THENNO(TUNE)=213:PRINT"E'' ";
  67IFA$=","THENNO(TUNE)=217:PRINT"F'' ";
  68IFA$="L"THENNO(TUNE)=221:PRINT"F#''";
  69IFA$="."THENNO(TUNE)=225:PRINT"G'' ";
  70IFA$=";"THENNO(TUNE)=229:PRINT"G#''";
  71IFA$="/"THENNO(TUNE)=233:PRINT"A'' ";
  72IFA$="]" ORA$="[" ORA$="_" ORA$="^" ORA$="\" ORA$=
":" ORA$="@" THEN36
  73SOUND&0012,E%,NO(TUNE),10
  74NT%=NO(TUNE):PROCNOTE(NT%)
  75 UNTILASC(A$)=13ORTUNE=40
  76PROCNOTE(0):N%=TUNE-1:ENDPROC
  77DATAQ,W,E,R,T,Y,U,I,O,P,Z,X,C,V,B,N,M,<,>
  78DEFPROCREPLAY
  79CLS:PROCSTAVE(2):VDU5
  80FORTUNE=1TON%:SOUND&0012,E%,NO(TUNE),DUR(TUNE):NT%
=NO(TUNE):D=DUR(TUNE):PROCNOTE(NT%):PROCQVR(TUNE,NT%,D,
2)
  81TM=TIME:REPEAT UNTILTIME>=TM+DUR(TUNE)*5
  82NEXTTUNE:VDU4:ENDPROC
  83VDU4:ENDPROC
  84DEFPROCBACKWARDS
  85CLS:PROCSTAVE(2):VDU5:FORTUNE=N%TO1STEP-1:SOUND&00
12,E%,NO(TUNE),DUR(TUNE):BKW=N%-TUNE+1:NT%=NO(TUNE):D=D
UR(TUNE):PROCNOTE(NT%):PROCQVR(BKW,NT%,D,2)
  86TM=TIME:REPEAT UNTILTIME>=TM+DUR(TUNE)*5
  87NEXTTUNE:VDU4:ENDPROC
```



```
88DEFPROCTRANSPOSE
89IFB%>0THENCLS:COLOUR1:PRINT'''"TRANSPOSE":COLOUR3:G
OTO92
90CLS:GCOL0,2:MOVE20,50:DRAW20,500:PLOT85,1260,500:D
RAW1260,50:PLOT85,20,50:VDU5:MOVE100,468:GCOL0,1:PRINT"
TRANSPOSE"
91RESTORE99:GCOL0,0:FORI=1TO8:READMES$:MOVE30,404-I*
32:PRINTMES$:NEXTI:VDU4
92PRINT'''"DO YOU WISH TO TRANSPOSE":PRINT"UP (U) OR
DOWN (D) ?":Y$=GET$:IFY$="U"ORY$="D"THEN93ELSE92
93IFB%<1THENB%=1:CLG:PROCKEYBOARD
94PRINT'''''"HOW MANY SEMITONES (1-9) ?":Y=GET:IFY<4
9ORY>57THEN94
95SEMI=-1*(48-Y):PRINTSEMI:FORTRANS=1TOSEMI:FORTUNE=
1TON%
96IFY$="D"THENNO(TUNE)=NO(TUNE)-4:IFNO(TUNE)<17THENN
O(TUNE)=253
97IFY$="U"THENNO(TUNE)=NO(TUNE)+4:IFNO(TUNE)>253THEN
NO(TUNE)=17
98NEXTTUNE:NEXTTRANS:PROCREPLAY:ENDPROC
99DATA"THIS IS THE FIRST TIME ON THIS RUN","THAT YOU
 HAVE USED  TRANSPOSE !!"," "
100DATA"NOTES TOO HIGH WILL HAVE TURNED","INTO LOW NO
TES - AND EXTRA LOW NOTES","WILL HAVE BECOME VERY HIGH
!!"," ","NOT ALL WILL BE SHOWN ON THE KEYBOARD"
101DEFPROCSPEED
102CLS:PRINT'''"METRONOME CHANGE (M)"'''"OR PLAY TUNE "
;:COLOUR2:PRINT"FASTER  (F)":COLOUR3:PRINT'"OR PLAY TUN
E ";:COLOUR2:PRINT"SLOWER  (S)":COLOUR3
103Y$=GET$:IFY$="M"THEN108ELSEIFY$="F"ORY$="S"THEN104
ELSE103
104FORTUNE=1TON%
105IFY$="F"THENDUR(TUNE)=DUR(TUNE)/2
106IFY$="S"THENDUR(TUNE)=DUR(TUNE)*2
107NEXT TUNE:GOTO109
108CLS:PRINT'''CHR$(227);PRINTCHR$(226);" = ?   (INIT
IAL VALUE = 72)":PRINT'''"SET VALUE IN RANGE 1 - 100 {RE
TURN} ":PRINT':INPUTM%:M%=INT((100-M%)/2)
109PROCREPLAY:ENDPROC
110DEFPROCINST
111CLS:PRINT'''"E N V E L O P E":PRINT'''"THERE ARE 4
POSSIBLE ENVELOPES":PRINT'"CHOOSE";:PRINTTAB(15);"1
ORGAN":PRINTTAB(15);"2      HARPSICHORD"
112PRINTTAB(15);"3      SYNTHESISER":PRINTTAB(15);"4
   WHISTLE/SIREN":PRINT'"YOU WILL RETURN TO MENU FRO
M HERE !"
113Y=GET:IFY<49ORY>52THEN113
114E%=-1*(48-Y):PRINTE%:ENDPROC
115DEFPROCINVERT
116IFA%>0THENCLS:COLOUR1:PRINT'''"UPSIDE DOWN":COLOUR3
:GOTO122
117CLS:GCOL0,2:MOVE20,50:DRAW20,500:PLOT85,1260,500:D
RAW1260,50:PLOT85,20,50:VDU5
118GCOL0,1:MOVE100,468:PRINT"UPSIDE DOWN"
119GCOL0,0:RESTORE124:FORI=1TO10:READMES$:MOVE30,404-
I*32:PRINTMES$:NEXTI:VDU4
120Y=GET:IFY=32THENA%=1:CLG:PROCKEYBOARD:GOTO122
121IFY=77THENCLG:PROCKEYBOARD:GOTO123ELSE120
122FORTUNE=1TON%:INV(TUNE)=250-(NO(TUNE)):NEXTTUNE:PR
OCPLAYINVERT
123ENDPROC
124DATA"ON THIS RUN THIS IS THE FIRST TIME THAT","YOU
 HAVE TURNED THE TUNE UPSIDE DOWN"
125DATA"MIDDLE C BECOMES C ABOVE MIDDLE C","BUT D BEC
OMES A# :HIGH NOTES GO LOW","AND LOW NOTES GO HIGH (MAT
HS NOT MUSIC)"
126DATA"IT'S ONLY MEANT AS A DEMONSTRATION !"," ","IF
 YOU WISH TO CONTINUE","PRESS SPACE BAR"
127DATA"OTHERWISE PRESS M (MENU)"
128DEFPROCPLAYINVERT
129IFA%<1THENPROCINVERT
130CLS:PROCSTAVE(2):VDU5:FORTUNE=1TON%:SOUND&0012,E%,
INV(TUNE),DUR(TUNE)
131NT%=INV(TUNE):D=DUR(TUNE):PROCNOTE(NT%):PROCQVR(TU
NE,NT%,D,2)
132TM=TIME:REPEAT  UNTILTIME>=TM+DUR(TUNE)*5
133NEXTTUNE:VDU4:ENDPROC
134DEFPROCBACKINVERT
135CLS:PROCSTAVE(2):VDU5:IFA%<1THENPROCINVERT
136FORTUNE=N%TO1STEP-1:SOUND&0002,E%,INV(TUNE),DUR(TU
NE)
137BKW=N%-TUNE+1:NT%=INV(TUNE):D=DUR(TUNE):PROCNOTE(N
T%):PROCQVR(BKW,NT%,D,2)
138TM=TIME:REPEAT  UNTILTIME>=TM+DUR(TUNE)*5
139NEXTTUNE:VDU4:ENDPROC
140DEFPROCTITLE
141VDU23,225,4,6,5,4,4,4,4,4:VDU23,226,4,4,52,124,252
,120,48,32:VDU23,227,4,4,4,4,4,4,4,4:VDU23,228,4,4,52,7
6,132,72,48,32:VDU23,229,0,0,48,76,132,72,48,32:VDU28,0
,31,39,15:M%=14
142PROCSTAVE(2):COLOUR1:PRINTTAB(0,16);"YOU CAN PLAY
A SIMPLE TUNE ":PRINT"ON THE COMPUTER KEYBOARD"
143COLOUR2:PRINT'"YOU CAN THEN ALTER THIS TUNE IN":PR
INT"A NUMBER OF WAYS -":PRINT"YOU CAN TRANSPOSE IT, INV
ERT IT,"
144PRINT"PLAY IT BACKWARDS OR PLAY IT":PRINT"FASTER O
R SLOWER !!"
145VDU5:SH%=0:GCOL0,3:FORTLE=1TO40:R%=101+4*INT(RND(2
1)):D=RND(28):PROCQVR(TLE,R%,D,2):SOUND&0012,-15,R%,D
146TM=TIME:REPEAT  UNTILTIME>=TM+D*5:NEXTTLE
147GCOL0,1:MOVE0,600:PRINTCHR$(225);"    T U N E S":P
RINTCHR$(226):VDU4
148COLOUR3:FORJ=0TO1000:NEXT:PRINT'''"HIT SPACE BAR W
HEN READY"
149*FX15,0
150Y=GET:IFY<>32THEN150
151ENDPROC
152DEFPROCKEYBOARD
153GCOL0,1:MOVE20,50:DRAW20,500:DRAW1260,500:DRAW1260
,50:DRAW20,50
154GCOL0,3:MOVE40,100:DRAW40,300:PLOT85,1240,300:DRAW
1240,100:PLOT85,40,100
155GCOL0,0:FORI=50TO1220STEP40:MOVEI,100:DRAWI,300:NE
XTI
156N=1:M=2:FORI=90TO1220STEP40
157IFI/10=N*33-(N-1)*5THENN=N+1:NEXTI
158IFI/10=M*11-(INT(M/3)+1)*5THENM=M+3:NEXTI
159FORJ=I-10TOI+10STEP2:MOVEJ,200:DRAWJ,300:NEXTJ:NEX
TI:ENDPROC
160DEFPROCNOTE(NT%)
161IFTUNE>1THENGCOL0,0:PROCPOINT(XOLD%)
162X%=(NT%-101)/4:FORI=0TO3:IFNT%>117+I*48THENX%=X%+1
163IFNT%>145+I*48 THENX%=X%+1
164NEXTI:GCOL0,3:PROCPOINT(X%):XOLD%=X%:ENDPROC
165DEFPROCPOINT(P%)
166ARR%=70+P%*20:MOVEARR%,350:DRAWARR%,450:MOVEARR%-2
0,400:DRAWARR%,350:DRAWARR%+20,400:ENDPROC
167DEFPROCSTAVE(S)
168GCOL0,S:FORI=1TO5:MOVE0,896-I*32:DRAW1280,896-I*32
:NEXTI:ENDPROC
169DEFPROCQVR(TUNE,NT%,D,CL%)
170RAN=INT(RND(3)):IFRAN<1THEN170
171IFNT%<101 OR NT%>185THENGCOL0,RAN:MOVE20,600:PRINT
"OFF THIS STAVE":GCOL0,3:ENDPROC
172MOVE20,600:GCOL0,0:PRINT"OFF THIS STAVE":GCOL0,3
173K%=(NT%-101)/4: IF K%=1 OR K%=3 ORK%=6 ORK%=8 ORK%
=10 ORK%=13 ORK%=15 ORK%=18 THENK%=K%-1:SH%=1
174IFK%<12THENK%=INT((K%+1)/2)ELSEIFK%>=17THENK%=INT(
(K%+3)/2)ELSEK%=INT((K%+2)/2)
175IFK%=0THENGCOL0,CL%:MOVE(TUNE*32)-32,704:DRAW(TUNE
*32),704
176IFK%=12THENGCOL0,CL%:MOVE(TUNE*32)-32,704+K%*16:DR
AW(TUNE*32),704+K%*16
177IFSH%=1THENSH%=0:GCOL0,3:MOVE(TUNE*32)-64,720+K%*1
6:PRINT"#" ELSESH%=0
178GCOL0,3:MOVE(TUNE*32)-32,720+K%*16:IFD<M%THENPRINT
CHR$(226)ELSEIFD>M%*2PRINTCHR$(229)ELSEPRINTCHR$(228)
179MOVE(TUNE*32)-32,(720+K%*16)+32:IFD<M%/2THENPRINTC
HR$(225)ELSEIFD>M%*2THENPRINT""ELSEPRINTCHR$(227)
180ENDPROC
```

Questions & Answers

Bruce Smith

Hardware, Software, Tricks of the Trade: Bruce Smith has the answers.

The error message saga continues! Thanks to Ewan Macleod of Stewarton who has found the solution to a couple of the undocumented error messages, Bad Address and Bad string. Bad Address occurs when an invalid address is specified with the *SAVE command. For example *SAVE"Program" FFE0 FFFFFFFFF, since FFFFFFFFF is too large! Bad String is issued when a nonsensical definition is written to a function key, for example *KEY0.

Not to be outdone Ewan has un-earthed some more undocumented error messages to add to our list, they are,

No Filing System (ERR 248)
Key in use (ERR 250)
Any offers?

Q: Mr. Richmond from Crowborough in Sussex has his Beeb connected to an Epson FX80 printer and writes, "Many of the commands listed in the very good (if you say so! BS) Epson Handbook do not work on my BBC. I have tried using both the CHR$ and VDU functions but without success. For example, how do you underline text? The Handbook gives the sequence of codes as CHR$(27);"-";CHR$(1) but I cannot get this or any VDU variant to work. Help!"

A: The CHR$ codes you give above are indeed correct, however the '-' should be specified as an ASCII code therefore you should use CHR$(27);ASC"-";CHR$(1). The simplest way to send control codes to any printer is to use the VDU1 statement. Therefore the correct VDU sequence to turn the underlining facility on would be, VDU 1,27,1,45,1,1

The following list of Epson printer codes might also be of use.

Underlining off: VDU 1,27,1, 45,1,0
Emphasised print on: VDU 1,27, 1,69
Emphasised print off: VDU 1,27, 1,70
Double width on: VDU 1,14
Double width off: VDU 1,20
American Characters: VDU 1, 27,1,5,1,0
English Characters: VDU 1,27, 1,55,1,1

Q: Mr. Bowns from Rotherham writes "In the Jan/Feb issue article 'Disc Environment' reference was made to any Disc Filing Sytem "Greater than 0.90". My Beeb has a 0.90 DFS does this mean I have been sold an outdated DFS?"

A: The answer is no, in fact the only DFS Acorn have officially released is the 0.90, however various other versions seem to have been 'sneaked' out!

In fact just today (Friday April 13th!) I innocently typed *HELP into an unattended Beeb somewhere in England(!) to find it had a DFS 1.2.

Acorn will in fact be releasing a 1.0 DFS for use with their Z80 Second Processor as the 0.90 is unable to handle the Second processor.

Q: Eric Lamb writes from Cardiff in Welsh Wales to inform us of some trouble he has had running David Green's Formula One program in the NOV/DEC issue of last year. He says, "As I was loading the program in from disc I included the memory shift routine provided to relocate the program from &E00. However the Beeb comes up with 'Syntax error, Bad program.' Without the memory shift the computer generates, as one would expect with such a long program, the error 'Error 25 at line 1020'. Please can you Help?"

A: The memory shift routine as it stands in the program is correct, however it assumes that an Acorn or Watford DFS is in use and no memory has been grabbed by any Paged ROMs. Are you using an Amcom DFS? This DFS allows PAGE to be set to &1500, and this would be where your program is loaded into. Therefore any references to &1900 would need to be altered to &1500.

Do you have any Paged ROMs installed? Several of those marketed 'grab' memory above the normal value of PAGE to use as workspace. The net affect of this is to increase the value of PAGE, if this is the case then the memory shift routine would start off by shifting this area of memory down to &E00, followed by the BASIC program. The interpreter would then try to run the 'workspace', thus the error.

I suggest you re-write the first 3 lines thus,

```
1  *KEY0 DELETE 1,3|M
   FOR I% = 0 TO TOP-PAGE:
   I%!&E00 = I%!PAGE:NEXT|
   M *TAPE|MPAGE = &E00|
   MRUN|M
2  *FX 138,0,128
3  END
```

This should do the trick.

Q: J.A. Livesey from Blackpool is the proud owner of a BBC Micro, who has recently purchased joysticks and asks "could you explain how I may use the joysticks to control events in my programs instead of the keyboard".

A: Before using your joysticks its a good idea to calibrate them. The following program use the ADVAL command to read and display the value present on each of the four channels associated with the Analogue Port.

```
10 REM JOYSTICK
   CALIBRATION
20 REPEAT
30 CLS
40 PRINT "CH READING"
50 FOR N% = 1 TO 4
60 PRINT TAB
   (1,4 *N%);N%;
70 PRINT SPC(5);
   ADVAL(N%)
80 NEXT
90 TIME = 0
100 REPEAT UNTIL
    TIME = 100
100 UNTIL FALSE
```

If you have dual joysticks then two channels will be associated with each one, ie Channels 1 and 2 will respond to Joystick 1 and Channels 3 and 4 will respond to Joystick 2 when run, and with the joysticks centered, Channels 1 and 2 and Channels 3 and 4 should read roughly similar values.

Now take one joystick and move it through the four compass points, North, South, East and West making a note of the maximum and minimum values produced. By moving joystick 1 to the extreme left the reading on Channel 1 should increase to around &65500 (NB these figures are only guides and will depend on the joystick you use), Moving it to the extreme right will produce a reading of around 32. Channel 2 will respond in a similar manner with corresponding North and then South movements.

Once these maximum and minimum values are noted it is simple to adapt programs. For example the lines,

```
100 KEY% = GET
110 IF KEY% = ASC"L' THEN
    PROC_move_left
120 IF KEY% = ASC"R" THEN
    PROC_move_right
130 IF KEY% = ASC"U" THEN
    PROC_move_up
140 IF KEY% = ASC"D" THEN
    PROC_move_down
```

would become

```
100 adval1% = ADVAL(1):
    REM left-right movement
105 adval2% = ADVAL(2):
    REM up-down
110 IF adval1%>65000 THEN
    PROC_move_left
120 IF adval1%<100 THEN
    PROC_move_right
130 IF adval2%>65000 THEN
    PROC_move_up
140 IF adval2%<100 THEN
    PROC_move_down
```

This example is a very simple one, but it does illustrate the basic techniques involved. Remember that you may need to alter the numbers above to suit your own joysticks. Finally you can use the ADVAL(0) statement to test to see if the fire button has been pressed. I suggest you read the commentary regarding ADVAL in the User Guide, pages 202 to 204.

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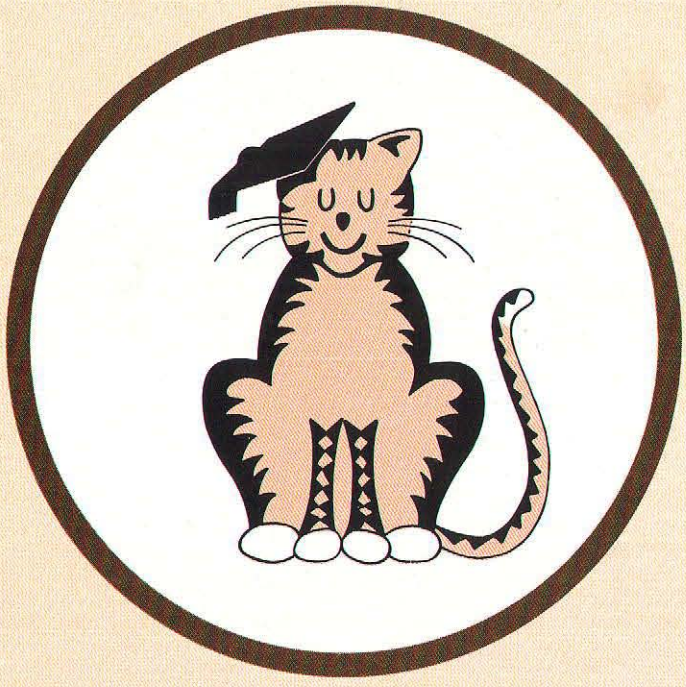

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Walk Before You Run

Richard Ives

Loop the loop as we put in some more hours in the A&B BASIC trainer.

If you have followed my series in "A&B Computing" this far you will be able to PRINT things on the screen in weird and wonderful ways and be able to put values into variables in various vivid ways. If you've missed my last two articles rush out and purchase the back issues now!

This month I'm going to show you how to get the computer to repeat your instructions time and again while you sit back and watch, or go to the lav. as the mood takes you. It is the ability to repeat instructions very rapidly many times over that makes computers, actually rather stupid machines, appear to be very clever. Since the instruction can be somewhat different each time it is repeated, we gasp in amazement at the supposed intelligence of the electronics, but it's all done with BASIC, and some humans (clever ones, no doubt) wrote that. After reading this you'll become quite blasé about it all; so if you don't want to lose the sense of wonder that comes from not understanding something, then read no further.

O.K., now we've got rid of the faint-hearted, we'll continue. Unless you tell it otherwise, the computer carries out BASIC instructions in line-number order; that is, if you have a program like this:

```
10 NUMBER1=RND(3000) : NUMBER2=RND(3000)
20 PRINT "The two numbers are " ; NUMBER1 ; " and " ; NUMBER2
30 LET ANSWER = NUMBER1 + NUMBER2
40 PRINT "Sum of the two numbers = " ; ANSWER
50 END
```

The computer will start at line 10, carry out that instruction, move to line 20, do that instruction, and so on to line 50 where the END instruction will be obeyed and control will return to the keyboard. If, instead of the END statement at line 50 you put the instruction:

```
50 GOTO 10
```

the computer would go back to line 10 and do the instruction contained there once more. Carrying on to lines 20, 30, 40 and eventually coming to line 50 the computer would be sent back to line 10 again . . . for ever (or until you get fed up and press 'Escape', or else there is a power cut or the computer breaks down).

CONTROLLING THE LOOP

Since this is clearly an unsatisfactory way to end a program, and anyway, the output is impossible to read (unless you do a 'Control N' to get into 'page mode'), we need to learn some more sophisticated techniques of looping. First, let's try to get out of the loop in the program that we've written by testing the value of the answer to a question about whether we wish to continue:

```
42 PRINT "Do you want to carry on";
44 INPUT CARRYON$
46 IF CARRYON$="NO" OR CARRYON$='no'' OR CARRYON$ = "No" THEN STOP
```

(I used STOP here, rather than END just so we know that the computer has STOPped at line 46, rather than ENDed at line 50.)

Of course, we now have a rather different program, since each time it generates a pair of random numbers, the computer will wait for us to tell it if we want to continue. (By the way, notice the use here of the logical operator OR to allow for three possible ways of typing "no", I haven't allowed for the fourth possibilty: "nO", as this seemed a rather unlikely response!)

Suppose we knew how many numbers we wanted to generate; let's say 10. We could get the computer to keep count of how many times it had been round the loop, and to stop when it has done 10 loops. First, get rid of the lines we just added:

```
DELETE 42, 46
```

Now let's have an IF... THEN statement which will stop the loop when some variable reaches 10:

```
45 IF LOOPCOUNTER = 10 THEN STOP
```

Now set LOOPCOUNTER at 0 at the start of the program, and increase it by one each time the loop is looped:

```
5 LOOPCOUNTER = 0
35 LOOPCOUNTER = LOOPCOUNTER+1
```

The statement in line 35 is an extra-ordinary one if you think of it as a mathematical statement: to say that a variable is equal to itself plus one is obvious nonsense. The answer is not to think of it as a mathematical statement; it isn't, it's a BASIC statement. It is helpful, I find, to read the statement from right to left, rather than left to right. The best way of thinking about it is to imagine that the computer has little boxes where it stores the values of variables, like LOOPCOUNTER, which the programmer (you) has defined. Line 35 says: "Go to the box which you've called LOOPCOUNTER and take a copy of the number that you have currently stored there. Now add one to it, and store the result back in the box, rubbing out the original value you had there."

FOR THE NEXT TRICK

We need this kind of loop so often that BASIC provides a rather easier way of doing it than this. It's called a FOR... NEXT loop. With this we can define the starting and finishing values of the loop in the same statement, and we don't have to worry about incrementing the counter, the FOR... NEXT loop does that for us. So lines 5, 35, 45 which made up our counter can be replaced by:

```
5 FOR I=1 TO 10
45 NEXT I
```

and also type :
35 followed by RETURN and
50 followed by RETURN

as we don't need these lines any more. Now our loop between lines 5 and 45 uses the variable, 'I', as the counter or control variable of the loop, and the terminating value is 10. We could have used any numeric variable instead of 'I' (we could have used LOOPCOUNTER, but I was fed up with typing it!). Now we can have fun getting the computer to produce lists of information using FOR... NEXT loops. For example, you'll remember that each character on the keyboard is represented in the computer by its ASCII code, so that the number 65 represents the letter A, 66 the letter B, and so on. We could get a printout of the correspondence between ASCII number and character with the following program segment:

```
1000 FOR A=33 to 126
1010 PRINT "The ASCII code "; A; "represents the character "; CHR$(A)
1020 NEXT A
```

EXERCISE: This piece of program produces a very unsatisfactory-looking output, and you might like to try and improve that. See if you can get a pleasing tabular output. Perhaps you could print the number in a different colour to the character? (If you are using a BBC machine you will get slightly different results when in MODE 7, because some of the characters are represented by different codes.)

When using a FOR... NEXT loop we can increment the control variable of the loop by more than one, if we wish, by adding the STEP instruction, so we would have achieved the same effect if line 5 had been written like this:

```
5 FOR I = 1 TO 40 STEP 2
```

This would be rather silly unless we were using the variable, I, in our loop and wanted it to take on particular values. You can decrement a loop instead of incrementing it if you have a need for that sort of kinkiness, for example:

```
990 FOR Y = 50 TO 0 STEP - 1
995 PRINT "Y has the value "; Y
997 NEXT Y
```

FOR... NEXT statements always go together — you can't have a FOR without a NEXT or a NEXT without a FOR. However, you don't need to state the variable name after the NEXT, and, in fact, the loop will execute more quickly if you miss it out. For clarity, though, I suggest you generally put it in, unless speed is of the essence. If you choose a silly terminating value the computer won't give an error message but it will carry out the instructions in the loop at least once. So this program will PRINT the message once:

```
1 FOR Q = 50 TO 50
2 PRINT "I meant this to be
PRINTed 50 times!!!!"
3 NEXT Q
```

You also get predictable, but perhaps surprising, effects when you choose steps that mean that the variable doesn't exactly reach the terminal value. For example, the program segment:

```
1 FOR P = 0 TO 8 STEP 3
2 PRINT "How many times will
this statement be PRINTed?"
3 NEXT P
```

will loop three times, because P will not be greater than eight until the loop has been executed thrice. When the loop is finished the 'control variable' (in this case, P) will always be greater than the terminal value (which was 8 in this example). People often find this confusing when they try to reuse the same variable later in their program without resetting its value!

LOOPS OF UNCERTAIN LENGTH

Often when we need to get the computer to repeat a series of instructions we are not sure how many times they'll need to be repeated. In this case a FOR...NEXT loop is no good. Fortunately, users of BBC and Electron machines don't have to resort to using GOTOs, which are frowned on by 'proper' programmers, and certainly make a program harder to follow and to correct. We have a 'semi-structured' BASIC which provides, among other things, REPEAT... UNTIL loops. So we can get the computer to go on REPEATing a set of instructions UNTIL a particular condition is satisfied. For example, if we wanted to get a sensible answer out of the user of our program, and we suspected that they might find it difficult to give one, we could write a program segment:

```
300 REPEAT
310 PRINT "Please answer YES
or NO"
320 INPUT ANSWER$
330 UNTIL ANSWERS$
= "YES" OR ANSWER$ = "NO"
340 REM next line
```

Each time around the loop the computer will check to see if the condition specified in the UNTIL statement has become true. If it has, then the loop is exited. You will sometimes see loops with UNTIL statements like this:

```
999 UNTIL 0
or:
999 UNTIL FALSE
```

To understand this, you need to remind yourself that a computer can deal only with numbers, so that when it is asked to work out a logical expression such as those found in IF... THEN or UNTIL statements it has to treat TRUE and FALSE as numbers. TRUE is represented by −1 and FALSE by 0. So if we say REPEAT UNTIL FALSE the loop will go on for ever as FALSE cannot be TRUE! Similarly, UNTIL 0 will always be treated by the computer as FALSE, so we'll get a never-ending loop. Since the computer turns logical expressions into numbers, we can use any of the logical operators: AND, OR or NOT, after an UNTIL statement (or indeed, in an IF... THEN statement), although we must be careful with the syntax. If line 330 in the above piece of program was:

```
330 UNTIL NOT
(ANSWERS$ = "YES")
```

the loop would be terminated when anything other than "YES" was typed. If YES was typed, since the expression in brackets, ANSWERS$ = "YES", would have the value TRUE, and since NOT TRUE is FALSE, the loop would carry on looping!

EXERCISE: (i) Fancy playing around with random numbers? Then write a program to see how many goes, on average, the computer takes to generate a certain number, say 54, when you give it 100 to choose from.

Got the idea? Then read no further. If you want some help with this, read on: Set some variable equal to RND(100) and then put that within a loop, which is only exited when the variable equals 54. Then check how many goes it has taken to produce 54. Do this a large number of times (perhaps using a FOR... NEXT loop) and then work out the average number of goes taken. Before you write the program, work out what the answer should be and see if the computer goes it right!

(ii) Write a program to collect some personal details on several people, the number to be determined by the people who are using your program. Make sure that each person is asked the same series of questions, store the results for everyone (use arrays), and PRINT out a pleasing table of everyone's answers at the end. Don't let people get away with invalid answers if your program is able to check; for example, where a yes/no answer is required, make sure you get one, and where you ask for a number for an answer, like someone's age, or the number in their family, check the range or the answer for silly values and ensure a rude message is PRINTed if values are not in range. Have fun! See you in the next issue.

Electron Joy

Mark Webb

Add on a little First Byte fun to your Electron edge-connector and watch it jump for joy.

To many people's surprise, the Electron is finding a role in many homes as a games machine. The quick rush of quality games software from the established BBC gamesters like Micro Power and Superior Software is partly responsible for this unexpected direction.

The Electron was considered more a cheap entry point into the world of BBC BASIC, computer literacy and home education. Emphasis was laid upon the lower speeds at which the Electron was able to push graphics about the screen. All comparisons however were naturally with the BBC Micro and neglected to point out that the Electron was faster than the other popular microcomputers on the market, many of them almost wholly games machines.

Perhaps sometimes the Electron does look a little underpowered when PRINTing, VDUing or even CALLing an O.S. subroutine, but games programmers writing in assembly language have been able to squeeze the necessary pace out of the multicoloured mode pixels to bring Electron owners a fine range of arcade attractions.

The natural first step for Electron games players is the acquisition of a joystick. Witness the vast choice confronting Spectrum players. The BBC Micro has long relied on the type of joystick which plugs into the analogue to digital port. These are often oversensitive and do not suit the often vigorous action brought to bear on them. The games player demands a firm and positive response. Thus the 'Atari-style' joystick is preferred for playing arcade games. This is the type of joystick supported by the first widely available Electron add-on, the First Byte joystick interface.

ADDING-ON

First Byte Computers from Derby are mailing scores of their new add-on to games enthusiasts who want to play *A&F*'s Cylon Attack or Dynabyte's Pool away from the keyboard; intense, cross-logged on the floor or lazing back on the settee. Either way they think it's better than bending their fingers into unnatural keyboard contortions.

The First Byte interface is an unprepossessing cream plastic box about the size of a games cartridge. The First Byte logo is moulded into both sides, standing out the exact amount needed to steady the interface on a flat surface. Not that it really needs steadying. Once located on the Electron edge connector, the interface sits tight, immoveable. At the rear end of the unit is the nine pin female socket into which the joystick plugs.

The actual PCB on which the few necessary components are to be found is well made and sits inside the clip together casing. I can't visualise anyone having to take it back for another, not unless they drop it under the wheels of a passing articulated lorry anyway.

The most important question about any interface has to be "Does it work with the software I want to use?". If you play games on your Electron then there is a fair likelihood that the First Byte interface will allow you to play with a joystick. The interface comes with a program on cassette which is LOADed before CHAINing or *RUNing your favourite game. The First Byte program offers a two screen menu of well known games by the *A&Fs*, Micro Powers, and Dynabytes of this world. A simple numerical selection chooses which game you want to play. Now all you do is LOAD in the cassette for the game and procede as normal.

JOY TO PLAY

While actually playing a game of course, the joystick selection is all important but I suppose a duff interface could spoil things also. The First Byte interface certainly provides for more precise control of laser bases and so on with the joystick at higher speeds than can be achieved through the keyboard and with no perceivable lag between joystick and screen action.

When actually playing a few Micro Power games there did appear to be an anomaly between on-screen instructions and what the joystick actually did, not in the game itself but when asked to hit space bar or Fire to start, it was sometimes necessary to use the keyboard. There was no problem firing during the games although in Positron, where the Return key is the fire button for keyboard control, the use of a joystick actually slows down your ability to fire fast. This is purely a physical fact of life to do with the muscles in your thumb and the bounce back characteristics of the Electron Return key.

MORE FUN

Overall there is no doubt that games like Cylon Attack and Cybertron Mission are much more fun to play with the joystick and interface combination attached to your Electron. And it can help you to higher scores. A favourite trick of mine in Positron is to use the Fire button and the Return key (not disabled) at the same time, further increasing the rapid fire which is characteristic of this game.

The main problem with buying the First Byte interface is that no provision has been made for you to add further up-grades to your lone edge connector, so if you are thinking in terms of user port/printer port then you will have to be prepared to pull the joystick interface on and off the edge connector — not a good idea.

The First Byte joystick interface comes complete with the relevant instructions and software to instantly run a good selection of current games, plus software to convert your favourites from other sources such as ***A&B Computing***. (Look out for a key to joystick program converter in a forthcoming issue.) The interface is available from First Byte Computers, 10 Castlefields, Main Centre, Derby DE1 2PE, price £24.95

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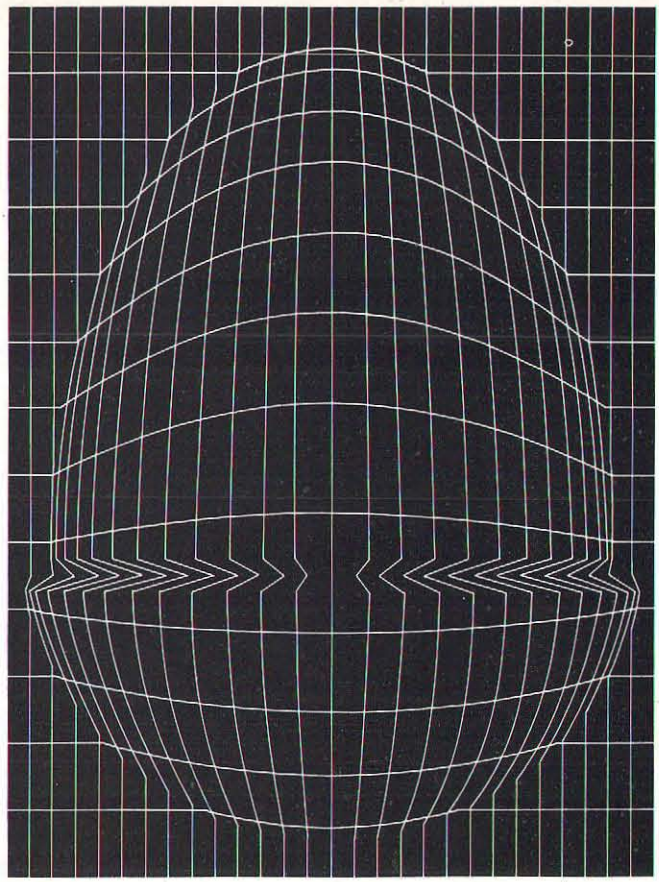

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Basutils

Dr S. Taylor

Search and Replace, Error listing and memory monitoring. Just some of the features of this Basic Utility Program.

BASUTIL is designed to assist programmers in the development, testing and correction of BASIC programs on the BBC computer. It is CHAINed before starting work on a BASIC program and then any program may be typed or loaded or run in the usual way. BASUTIL sits at the bottom of the memory and the program under development is moved higher up the memory. The user is unaware of the presence of BASUTIL and proceeds in the normal way unless he wishes to use the extra facilities available.

FUNCTIONING

Firstly, BASUTIL sets the red user defined keys to selected settings and also sets other parameters associated with the keyboard. Those shown in the program listing can be changed to suitable settings at the user's discretion. The most important key is f0. CTRL/f0 offers the following facilities:

1. Keys. Typing K resets the keys in case they have been altered by running another program.
2. Find. Typing F allows the user to search for a string of characters in a program. It lists the line numbers where it is found and the total number of occurrences. Strings containing BASIC commands cannot be found because the commands are abbreviated as tokens.
3. Replace. If a string is to be replaced by a different string then type R. When prompted, give the old string, the replacement string (of the same or different length) and the range of line numbers where replacement is required. Line number 0 (blank) indicates either the first or last lines of the program. replace is slow and will take some two minutes for a 20K program. Line numbers and occurrences are listed.
4. Token. Type T to find all occurrences of a token representing a BASIC command. These must be specified in hexadecimal (without &) as listed on pages 483 and 484 of the BBC User Guide. Line numbers and occurrences are again listed.
5. Memory. For details of the use of memory, type M. this gives HIMEM, bottom of the stack, top of the variables, LOMEM and PAGE. It also gives the mode, the free space, the space used by BASUTIL and the space taken by the program. These details are all given in hexadecimal. The space used by BASUTIL will be available for your program when it is run normally without BASUTIL. The space taken by variables and the stack is not correct unless this facility is used immediately after running a program.
6. Error. Typing E reports the last error which occurred and then lists the program starting at the line number at which the error occurred. If escape has been used in a LIST operation, this facility continues the listing from the point of escape.
7. Clear. When ending a program, it is very useful to clear the screen, line by line, from the bottom so that information is not lost by scrolling. Type C for each line to be deleted and then press any other key to stop the process.

PROGRAM DETAILS.

As may be seen from the program listing, the program has been written so as to use a minimum of computer space. the list of facilities is concise and is deleted from the screen after use to avoid unnecessary scrolling. The facilities may be selected in upper or lower case characters.

PROC K, lines 100 to 310, is the part of the program of particular interest to the user and may be modified to suit ones personal preferences.

Line 100 sets the picture position to suit the equipment in use.
Lines 110 and 120 set the key repeat timings.
Line 130 sets the TAB key to print =.
Line 140 enables the cursor editing keys.
Line 150 sets the red user keys to produce "#$% & ' ( ) * + when used without the SHIFT key.
Line 160 sets the user keys to digits 0 to 9 when used with SHIFT.
Line 180 sets the user keys to give Teletext colour codes with CTRL & SHIFT.
Line 170 sets the user keys to behave as soft keys when used with CTRL. the soft keys are defined by lines 200 to 300.
Line 200 sets CTRL/f0 to operate BASUTIL after which the user is prompted to select one of the seven facilities described above.
Lines 210 to 290 (keys f1 to f9) may be set at the user's discretion.
My choice is CTRL/f1 to print PROC, CTRL/f2 to select my Hobbit system, CTRL/f3 to select the cassette tape and CTRL/f4 to catalogue the filing system. CTRL/f6, f7, f8, f9 are for saving, loading and chaining programs. to save a program type CTRL/f7, the filename and CTRL/f6. Load and chain work similarly.
Line 300 forces the BREAK key to issue OLD commands for both BASUTIL and the program under development.
Line 310 switches off the printer, enables the screen, restores default colours and switches on the CAPS LOCK. If you have version 0.1 replace ?602 by ?&DB.
Line 40 selects mode 7 and paged mode, since mode cannot be selected inside a PROC.

BASIC programmers need not be aware of the position of BASUTIL in the memory except that it uses 2k bytes of memory. Since 176 bytes of this 2k are not used, there is some elbow room for modifications and additions. Anyone using machine code will need to know that the program loads at &E00 and extends to &154F. PAGE is set to &1600. It also uses &84 to&8F for machine code. If you have a disc system, the initial value of PAGE is higher than &E00 so all references to &E00, 5632, 5633, 5634 (lines 20, 30, 50, 200, 300) must be incremented by the amount which the initial value of PAGE is moved.

Finally, if you prefer the memory details in decimal, omit the ~ characters in line 500.

PROGRAM LISTING

```
   10REM BASUTIL, S.Taylor
   20P%=&84:[OPT0:LDA#138:LDX#0:LDY&8F:JSR&FFF4:RTS:]:?
5632=&D:?5633=&FF:V%=5634:J%=75:GOTO40
   30PRINTTAB(0,VPOS-2)"Keys  Find  Rep  Token  Mem  Er
ror  Clr ?";:J%=GET:PRINTTAB(0,VPOS-1)SPC45TAB(0,VPOS-2
):U%=5632:V%=TOP:IFJ%>96ANDJ%<123J%=J%-32
   40IFJ%=75PROCK:MODE7:VDU14 ELSEIFJ%=70PROCF ELSEIFJ%
=82PROCR ELSEIFJ%=84PROCT ELSEIFJ%=77PROCM ELSEIFJ%=69P
ROCE ELSEIFJ%=67PROCC
   50@%=10:PAGE=5632:VDU7:END
  100DEFPROCK:*TV255
  110*FX11,25
  120*FX12,3
  130*FX219,61
  140*FX4,0
  150*FX225,34
  160*FX226,48
  170*FX227,1
  180*FX228,128
  200*KEY0R%=256*?5+?4:S%=256*?3+?2:PA.=&E00:G.30|M
  210*KEY1PROC
  220*KEY2MO.7|M
  230*KEY3*HO.|M
  240*KEY4*T.|M
  250*KEY5*.|M
  260*KEY6""|M"
  270*KEY7|MSAVE"
  280*KEY8|MLOAD"
  290*KEY9|MCHAIN"
  300*KEY100.|MPA.=5632|MO.|M
  310VDU3,6,20:?602=32:ENDPROC
  400DEFPROCF:INPUTLINE"Find "X$:X%=LENX$:IFX%=0ENDPROC
ELSEK%=0:L%=32767:PROCG:ENDPROC
  410DEFPROCG:@%=8:P%=U%+1:IF?P%=&FF ENDPROC
  420F%=0:REPEATM%=P%+P%?2:A%=256*?P%+P%?1:P%=P%+3:H%=0
:IFA%<K%ORA%>L%GOTO450
  430IFLEN$P%<X%GOTO450ELSEQ%=INSTR($P%,X$):IFQ%=0GOTO4
50ELSEP%=P%+Q%-1+X%:F%=F%+1:IFH%=0PRINTA%;:H%=1
  440GOTO430
  450P%=M%:UNTIL?P%=&FF:PRINT'"No"F%:ENDPROC
  500DEFPROCM:@%=7:PRINT"Himem",~HIMEM SPC7"Mode",?853'
"Stack",~R%SPC7"Free",~R%-S%'"Var'ble"~S%SPC7"BASUTIL
  800"'"Lomem",~V%'"Page",~U%SPC7"Program"~V%-U%:ENDPRO
C
  600DEFPROCE:@%=5:PRINTTAB(0,VPOS-2):REPORT:PRINTTAB(3
1);:*FX21,0
  610*FX138,0,76
  620*FX138,0,46
  630FORM%=1TO5:?&8F=ASCMID$(STR$ERL,M%,1):CALL&84:NEXT
:*FX138,0,44
  640*FX138,0,13
  650ENDPROC
  700DEFPROCR:LOMEM=HIMEM-256:INPUTLINE" Rep "X$:X%=LEN
X$:IFX%=0ENDPROC
  720INPUTLINE"  By "W$:W%=LENW$:C%=W%-X%:INPUT"From "K
%"  To "L%:IFL%=0L%=32767
  730PROCG:IFF%=0ENDPROC ELSEF%=C%*F%+1:T%=P%:IFF%<1F%=
1
  740T%=P%:REPEATT%?F%=?T%:T%=T%-1:UNTILT%<U%:P%=P%+F%:
G%=U%+1:T%=G%+F%:E%=T%
  750REPEATN%=E%?2:I%=E%+2:M%=E%+N%:A%=256*?E%+E%?1:E%=
E%+3:IFA%<K%GOTO800ELSEIFA%>L%UNTILTRUE:GOTO810
  760IFLEN$E%<X%GOTO800ELSEQ%=INSTR($E%,X$)-1:IFQ%<0GOT
O800
  770E%=E%+Q%:N%=N%+C%:IFT%=E%GOTO790ELSEREPEAT?G%=?T%:
IFI%=T%I%=I%+G%-T%
  780G%=G%+1:T%=T%+1:UNTILT%=E%:$G%=W$:G%=G%+W%:T%=T%+X
%:E%=E%+X%:GOTO760
  800E%=M%:?I%=N%:UNTIL?E%=&FF
  810REPEAT?G%=?T%:G%=G%+1:T%=T%+1:UNTILT%>P%:ENDPROC
  900DEFPROCC
  910Q%=GET:IFQ%=67ORQ%=99PRINTTAB(0,VPOS-1)SPC40TAB(0,
VPOS-2):GOTO910ELSEENDPROC
 1000DEFPROCT:INPUT"Token "X$:X%=LENX$:IFX%=0ENDPROC EL
SEK%=0:L%=32767:X$=CHR$EVAL("&"+X$):PROCG:ENDPROC
```

Competition

Schools, colleges, ITECs, clubs, user-groups and individuals are all welcome to enter this fun competition to win an **Epson RX80FT** printer worth over **£300** or the latest in Epson print technology, the tiny **P40** portable thermal printer, which is now in your shops for **£95 + VAT.**

The Epson RX80 is an established favourite with BBC Micro users, offering full ASCII and international character sets, numerous different print modes, italics, underline and so on. It also has the all important 'bit-image' printing capability.

The new P40 is a thermal dot-matrix with printing speed of 45 characters per second. It uses a standard 40 columns but is capable of producing 80 with condensed mode and 20 with enlarged character size. It is also possible to use the printer for bit image printing.

All you have to do to win one of these superb prizes is to come up with a graphics routine in BBC BASIC/Assembler to demonstrate the bit image printing offered by the Epson range of printers. The routine can produce anything from a graphical representation of a Constable painting to the most modern in computer art.

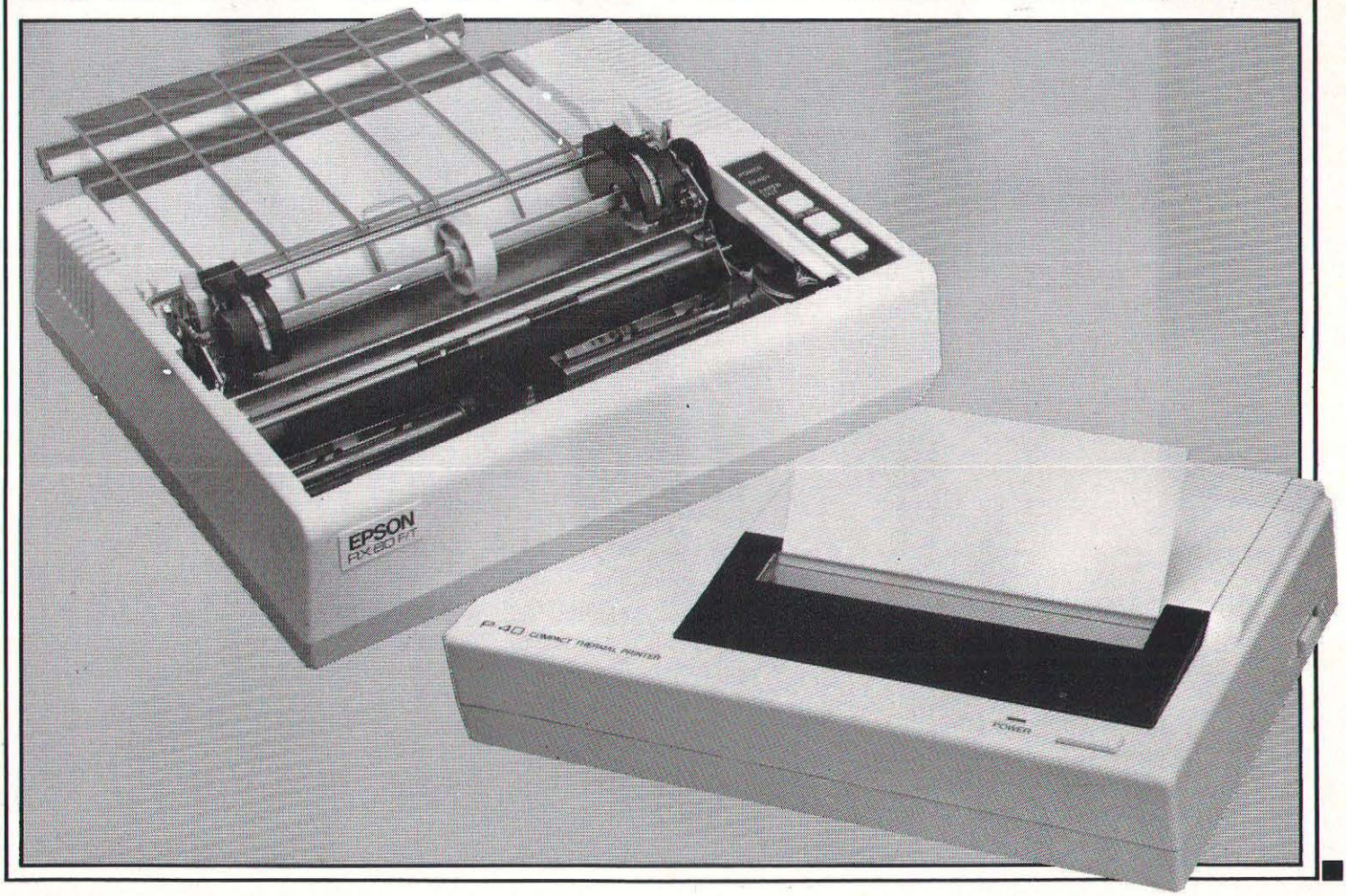
If you already have a printer at your disposal then send us a printout of your masterpiece. Use a grey shade dump if possible — there's one in the Jan/Feb issue of ***A&B Computing***. If you can't get to a printer then send us your routine on cassette (clearly labelled with your name and address) and we will take a look at it 'live'. All cassettes will be returned if accompanied by an SAE. There's plenty of time so why not have an artistic fling and win yourself a new printer in the process.

The winners of the competition will be the creators of the two most original and attractive graphic designs in the opinion of the editor. The winners will be notified once the competition has closed and the results will be published in a future issue of *A&B Computing*. The competition is open to all UK and Northern Ireland readers of A&B except employees of Argus Specialist Publications Ltd., their printers and distributors, employees of Epson or anyone connected with the competition.

All entries must be postmarked before 31st August 1984. No correspondence will be entered into with reference to the results and it is a condition of entry that the editor's decision is accepted as final.

WINNERS

The attraction of winning one of Mosaic Publishing's BBC titles, My Secret File or The Pen and the Dark, proved too strong for hundreds of A&B readers who all guessed correctly that the up and coming title we were looking for was "Stainless Steel Rat". The ten lucky winners out of the sombrero were: B. Teasdale of Bristol; Colin Serplus, Co. Armagh; Mr L. Poxon, Chorley; Keith Wolstenholme, Manchester; Mrs H. G. Crum of Eastbourne; Mr Spink, Bramley in Surrey; Kevin Wong, Newcastle; W. Coulson, Blyth; Sean Smith, Lernick, Shetland; S. Pilley, Rotherham.

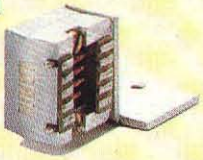


YES!

A 100k BBC-drive for £99 + VAT

We've done it! We've built a storage system for your BBC Micro with the power and convenience of a floppy disk drive, at a fraction of the price. Interface to the BBC costs £26 + VAT and runs up to 8 drives.

PHLOOPY's special secret

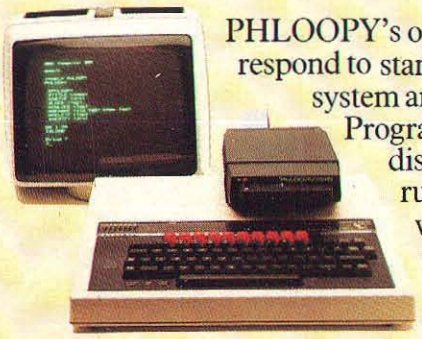


PHLOOPY does not record on a disk, but on a loop of quarter-inch tape contained in a rugged interchangeable cartridge.

The heart of PHLOOPY is a unique "byte-wide" magnetic head, that gives it its speed by recording nine tracks across the tape. Typically, you can access a file in only 3 or 4 seconds.

If you're used to waiting for a cassette tape to trundle programs into your BBC, you'll be amazed at PHLOOPY's performance – up to 100 times faster.

Talking to your PHLOOPY



PHLOOPY's own software makes it respond to standard BBC filing system and Basic commands. Programs written to run on disk or cassette should run on PHLOOPY without problem. And because your PHLOOPY drive contains its own microprocessor – a second computer which does most of the hard work – it puts very little load on the BBC. The on-board computer also checks and automatically corrects any read errors.

Your PHLOOPY Library

PHLOOPY cartridges hold a full 100k of data. You can buy blank cartridges for £3.75 each plus VAT. Many BBC programs will be available on PHLOOPY.

Phi Mag Systems Ltd. PO Box 21, Falmouth, Cornwall TR11 3TD Tel: (0326) 76040

Order Form

- Please send me further details about the PHLOOPY 100k data storage system for the BBC Model B.
- Please send me_____(qty) PHLOOPY starter pack(s) for my BBC Model B microcomputer, including PHLOOPY drive, BBC interface, leads, connections, operating system in firmware, manual, and two PHLOOPY 100k cartridges, at £147.75 each including VAT, postage and packing. Amount £_____
- Please send me_____(qty) packs of 5 PHLOOPY cartridges at £19.75 including VAT, postage and packing. Amount £_____

I enclose a cheque/PO for £_____ OR Please debit my Access card Number: _____

Your order will be acknowledged within 10 days, giving a delivery date.

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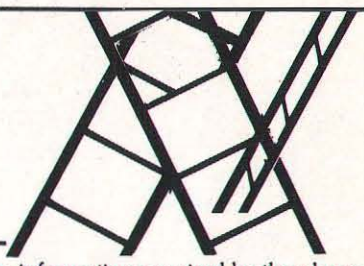
14 day money-back option.

A&B

Snakes and Ladders Maths

Ken Goodman

Meet the mathematical challenge of this highly entertaining and educational program.

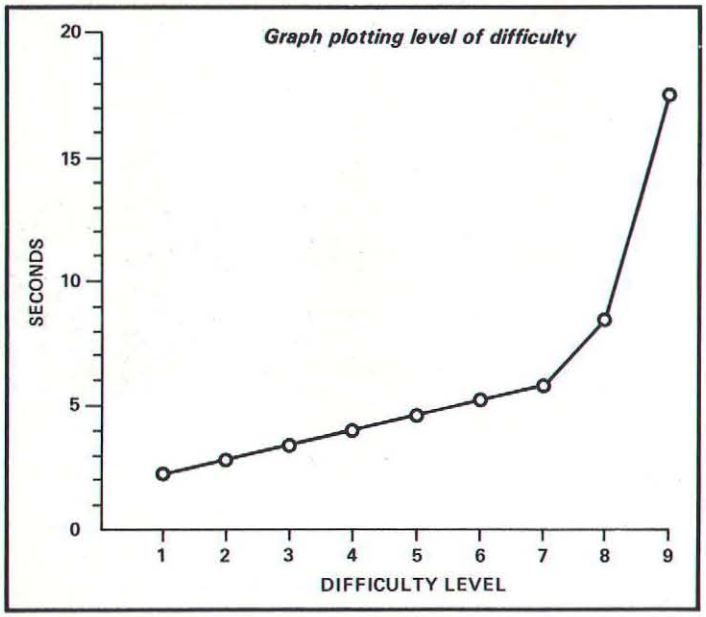


This is a game of Snakes & Ladders containing an arithmetic quiz for children of Primary-school age. This quiz has two particularly useful features (a) there are three choices of question. (b) the level of difficulty is constantly adjusted to the level of skill of the player by controlling the time element. If the success rate is equal to or less than 1 in 3, the difficulty is increased a little and vice versa if the rate exceeds 2 in 3.

In addition the program plays a very attractive game of Snakes & Ladders with a nice clear layout — welcome change perhaps from the munchers and ladder-climbers.

CHALLENGE

To make the game something of a challenge to older children up to age 80, the time scale within which an answer must be entered has been given an extensive coverage. Diagram 1 illustrates the range for various difficulty-levels. this is controlled by the value of 'limit' in line 1210. If you don't like the range, change the values accordingly (but bear in mind that 'diff' in this line is 10 — difficulty-level). If you fancy your chances, try option 3 at difficulty-level 1. We don't think you will be able to stay there long.

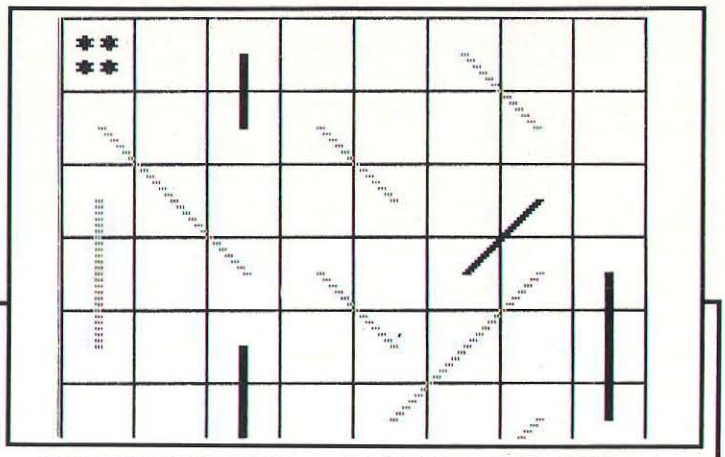


PROGRAM OPERATION

PROCtitle	Lines 1010-1070 Puts Title on screen in Mode 7
PROCinit	Defines characters and Envelopes and sets the starting values of variables. Variables plx%(I), ply%(I%) are the X and Y co-ordinates of each player-position in the 64 cells of the board. the values of these arrays are loaded in lines 690-740.
PROCOptions	The Procedures use Mode 7 to set the Sound and Game options.
PROCboard	Draws the board in Mode 1. Lines 850-960 draw the snakes as thick white lines and the ladders as dotted green lines. This combination makes it possible to use the program on monochrome screens if necessary.
PROCgen	This gives all the information required by the player and prints it alongside the main board.
PROCplay	This is the main Procedure or the game and repeats until either the player or the computer arrives at the last cell on the board.
PROCmaths	Line 1170 uses an ON. . . GOSUB routine to deal with the differing options. Thus line 1420 sets a low or high number addition sum depending on the option selected. Lines 1440-1500 deal with subtraction, multiplication and division. Line 1210 sets the time available for entering an answer. Lines 1220-1260 make it unnecessary to use RETURN with an entry. Line 1310 compares the player's answer with the correct answer. Lines 1330, 1340 take sample batches of 3 tries and adjust the difficulty level up or down if there are more or less than 2 correct answers.
PROCthrow	Draws a box in which to display the dice number — lines 1610, 1620. It selects and prints random numbers 1 to 6 for 2 seconds and then leaves the last number displayed.
PROCmoveP	This deals with the player's move. Line 1740 uses the plx%(PP)m ply%(PP) co-ordinates to print the move from cell to cell and calls FNcheck con completion to see whether the last throw has landed on the base of a ladder or on the head of a snake.
PROCmovec	This covers the computer's move and operates in a similar way to that above but adds 1 to the X co-ordinates to print the computer symbol to the right of the player's symbol.
FNcheck(n)	n is returned as the last cell-value of a move and the function compares this number with known values of ladders and snakes. When one of these values is met, n is adjusted to the new value for printing.

MAIN VARIABLES

cans	Correct answer.
com$/pl$	Computer/Player symbol.
CP/PP	Computer/Player cell number.
cthrow	Set to TRUE or False to differentiate between Player's and Computer's throw.
diff	Selected difficulty-level.
level	Equal to 10 — diff.
limit	Max. time allowed in which to answer.
n	Values of cells containing bases of ladders or heads of snakes.
ok	Number of correct answers per sample.
opt	Selected option number.
out$	Symbol delete.
plans	Player's answer.
plx%( )	X and Y co-ordinates for each cell's printing.
ply%( )	Position.
tries	Keeps a check on sampling for difficulty regulation.



PROGRAM LISTING

```
  10REM::::SNAKES & LADDERS MATHS:::
  20REM::::::::::::::::::::::::::::
  30REM:::::::By Ken Goodman::::::::
  60ONERROR GOTO2210
  70MODE2:VDU23;8202;0;0;0;:PROCtitle
  80PROCinit:MODE7
  90REPEAT:CLS:VDU23;8202;0;0;0;
 100PP=1:CP=1:tries=0:ok=0
 110PROCsound:PROCoptions
 120MODE1:VDU23;8202;0;0;0;:VDU19,1,2;0;:zz=RND(-TIME)
 130PROCboard:PROCgen
 140REPEAT PROCplay:UNTILPP=64 ORCP=64
 150IFPP=64 MODE7:PROCend1 ELSEIFCP=64 MODE7:PROCend2
 160UNTILfinish=TRUE
 170MODE7:END
 180DEFPROCoptions
 190PRINTTAB(0,13)CHR$130"What type of question will y
ou have ?"
 200PRINTTAB(3,16)"1 - Multiplication Tables only."
 210PRINTTAB(3,18)"2 - Mixed arithmetic (Easy numbers)
"
 220PRINTTAB(3,20)"3 - Mixed arithmetic (Harder number
s)"
 230PROCkeylock
 240REPEAT opt=GET:UNTILopt>48 ANDopt<52
 250opt=opt-48:CLS
 260PRINTTAB(8,11)CHR$130"How difficult (1 - 9) ?"
 270PRINTTAB(9,13)CHR$131"1 is hard   9 is easy"
 280PRINTTAB(0,17)"BEEB will adjust it for you as you
play":PROCkeylock
 290REPEATdiff=GET:UNTILdiff>48 AND diff<=57:diff=58-d
iff
 300ENDPROC
 310DEFPROCgen
 320COLOUR2:PRINTTAB(4,2)"SNAKES & LADDERS"
 330VDU28,26,31,39,0:COLOUR3
 340PRINTTAB(1,5)"In this game"'"you answer"'"arithmet
ic"'"questions to"'"throw the"'"dice."
 350PRINTTAB(1,13)"If you are"'"wrong or if"'"you take
 too"'"long,you lose your turn."
 360COLOUR1:PRINTTAB(1,19)pl$;"     You"
 370COLOUR2:PRINT'TAB(1)com$"     Computer"
 380COLOUR3:PRINT'TAB(1)STRING$(5,CHR$226);" SNAKE"
 390COLOUR1:PRINTTAB(1)"----- LADDER"
 400PROCkeylock
 410COLOUR2:PRINT'''TAB(1)"Press SPACE":ZZ=GET:CLS
 420COLOUR1:PRINTTAB(1,7)"Press RETURN  to throw the"'
"dice."
 430PRINT'''TAB(1)"You must get"'"the exact"'"number o
n the final throw."
 440COLOUR2
 450PROCkeylock:PRINT'''''TAB(1)"Press SPACE"
 460Z=GET:CLS:COLOUR2:PRINTTAB(0,7)"To even thingsout
a bit,you"
 470PRINTTAB(0,9)"are allowed   another turn  after th
rowinça six."
 480COLOUR1
 490PROCkeylock:PRINTTAB(1,17)"Press SPACE"
 500ZZ=GET:CLS:VDU26:PROCdl(1500)
 510ENDPROC
 520DEFPROCplay
 530PROCclear3:COLOUR2:PRINTTAB(28,28)"Difficulty":PRI
NTTAB(28,29)"level = ";10-diff
 540PROCmaths:PROCdl(500):PROCclear1:PROCclear2
 550IFNOTgo COLOUR1:PROCdl(700):PRINTTAB(29,10);"MISS
1 TURN":COLOUR2:PROCdl(2000):GOTO600
 560PRINTTAB(28,10)"YOUR MOVE":PROCthrow(0):PROCdl(100
0):PROCmovep
 570IFPP=64 ENDPROC
 580IFs v=-15 ELSEv=0
 590IFdice=6 COLOUR2:PRINTTAB(29,12);"AGAIN":SOUND1,v,
200,1:PROCdl(150):SOUND1,v,200,1:GOTO560
 600PROCdl(1000):PROCclear1:COLOUR2:PRINTTAB(29,10);"M
Y MOVE"
 610PROCdl(1000):PROCthrow(-1):PROCdl(1000):PROCmovec
 620IFCP=64 ENDPROC
 630PROCclear1:ENDPROC
 640DEFPROCinit
 650VDU23,224,0,24,24,0,255,0,24,24,23,225,-1,-1,-1,-1
,-1,-1,-1,-1,23,226,0,0,0,-1,-1,0,0,0
 660pl$="X"+CHR$10+CHR$8+"X":com$="O"+CHR$10+CHR$8+"O"
 670out$=" "+CHR$10+CHR$8+" ":win$="**"+CHR$10+CHR$8+C
HR$8+"**"
 680DIMplx%(65),ply%(65):addx%=1:addy%=29:ZI%=1
 690FORJ%=1TO4:FORI%=ZI% TOZI%+7
 700plx%(I%)=addx%:ply%(I%)=addy%:addx%=addx%+3:NEXT
 710ZI%=ZI%+16:addx%=1:addy%=addy%-6:NEXT:ZI%=9:addx%=
22:addy%=26
 720FORJ%=1TO4:FORI%=ZI% TOZI%+7
 730plx%(I%)=addx%:ply%(I%)=addy%:addx%=addx%-3:NEXT
 740ZI%=ZI%+16:addx%=22:addy%=addy%-6:NEXT
 750ENVELOPE1,1,20,100,0,1,1,6,127,-1,0,-7,126,126
 760ENVELOPE2,1,0,-12,0,65,1,65,126,0,0,-1,126,126
 770*FX11,0
 780ENDPROC
 790DEFPROCboard
 800GCOL0,2:MOVE16,1008:DRAW784,1008:DRAW784,816:DRAW1
6,816:DRAW16,1008
 810GCOL0,3:FORX%=16TO784STEP96:MOVEX%,784:DRAWX%,16
 820MOVE16,X%:DRAW784,X%:NEXT
 830COLOUR3:FORY%=10TO28STEP6:VDU31,25,Y%,94,31,25,Y%+
1,94,8,13:NEXT
 840GCOL0,1
 850X%=448:Y%=640:FORZI%=1TO3:MOVEX%,64:PLOT21,Y%,256:
X%=X%+4:Y%=Y%+4:NEXT
 860X%=448:Y%=640:FORZI%=1TO3:MOVEX%,256:PLOT21,Y%,448
:X%=X%+4:Y%=Y%+4:NEXT
 870X%=448:Y%=352:FORZI%=1TO3:MOVEX%,352:PLOT21,Y%,448
:X%=X%+4:Y%=Y%+4:NEXT
 880X%=256:Y%=64:FORZI%=1TO3:MOVEX%,448:PLOT21,Y%,640:
X%=X%+4:Y%=Y%+4:NEXT
 890X%=448:Y%=352:FORZI%=1TO3:MOVEX%,544:PLOT21,Y%,640
:X%=X%+4:Y%=Y%+4:NEXT
 900X%=60:Y%=60:FORZI%=1TO3:MOVEX%,352:PLOT21,Y%,544:X
%=X%+4:Y%=Y%+4:NEXT
 910X%=636:Y%=540:FORZI%=1TO3:MOVEX%,640:PLOT21,Y%,736
:X%=X%+4:Y%=Y%+4:NEXT
 920GCOL0,3
 930X%=252:Y%=252:FORZI%=1TO3:MOVEX%,64:DRAWY%,352:X%=
X%+4:Y%=Y%+4:NEXT
 940X%=732:Y%=732:FORZI%=1TO3:MOVEX%,256:DRAWY%,448:X%
=X%+4:Y%=Y%+4:NEXT
 950X%=544:Y%=640:FORZI%=1TO3:MOVEX%,448:DRAWY%,544:X%
=X%+4:Y%=Y%+4:NEXT
 960X%=252:Y%=252:FORZI%=1TO3:MOVEX%,640:DRAWY%,736:X%
=X%+4:Y%=Y%+4:NEXT
 970COLOUR1:PRINTTAB(plx%(PP),ply%(PP))pl$
 980COLOUR2:PRINTTAB(plx%(CP)+1,ply%(CP))com$
 990COLOUR3:PRINTTAB(plx%(64),ply%(64));win$
1000ENDPROC
1010DEFPROCtitle
1020COLOUR1:x=2:FORT%=1TO6
1030READch:PRINTTAB(x,7)CHR$ch:PROCdl(650):x=x+1:NEXT
1040COLOUR3:PRINTTAB(8,10)"AND":x=11
1050COLOUR2:FORT%=1TO7:READch:PRINTTAB(x,13)CHR$ch:PRO
Cdl(650):x=x+1:NEXT
1060PROCdl(1000):COLOUR7:PROCdl(2000):ENDPROC
1070DATA83,78,65,75,69,83,76,65,68,68,69,82,83
1080DEFPROCclear1:FORY=5TO22:PRINTTAB(26,Y)SPC14:NEXT:
ENDPROC
```

CONTINUED OVER

```
 1090DEFPROCclear2:FORY=1TO5:PRINTTAB(1,Y)SPC23:NEXT:EN
DPROC
 1100DEFPROCclear3:FORY=28TO29:PRINTTAB(28,Y);SPC11:NEX
T:ENDPROC
 1110DEFPROCkeylock
 1120IFNOT INKEY-129 THEN1120
 1130*FX15,1
 1140ENDPROC
 1150DEFPROCmaths:PROCclear2
 1160COLOUR2:PRINTTAB(28,28)"Difficulty":PRINTTAB(28,29
)"level = ";10-diff
 1170IFopt=1 GOSUB1470 ELSE ONRND(4) GOSUB1420,1440,147
0,1490
 1180COLOUR2:PRINTTAB(3,2)"What is ";n1;sign$;n2;" ?"
 1190*FX15,0
 1200COLOUR1:PRINTTAB(2,4)"Answer = ";:plans$="":TIME=0
 1210IFdiff<4 limit=1750/diff ELSElimit=-58*diff+757
 1220REPEAT
 1230REPEAT ZZ=INKEY375:UNTIL(ZZ-48)>=0 AND ZZ-48<10) OR
ZZ=-1
 1240IF ZZ<>-1 PRINT;ZZ-48; ELSE 1260
 1250ZZ$=STR$(ZZ-48):plans$=plans$+ZZ$
 1260plans=VALplans$:UNTILplans=cans ORLENplans$=LENSTR
$cans ORTIME>limit OR(ZZ=-1 ANDplans$<>"")
 1270PROCdl(650):tries=tries+1
 1280PROCclear2:COLOUR2:IFZZ=-1 THEN1320
 1290IFplans=cans PRINTTAB(2,3)"CORRECT":PROCdl(650)
 1300IFTIME>=limit PRINTTAB(2,3);"TOO LATE !":PROCdl(65
0):go=FALSE:GOTO1330
 1310IFplans=cans AND TIME<limit go=TRUE:ok=ok+1:GOTO13
30
 1320IFplans<>cans ORZZ=-1  go=FALSE:PRINTTAB(8,2)"WRON
G !";TAB(7,4)"It was ";cans:IFs VDU7
 1330PROCdl(1000):IFtries=3 ANDok<2 diff=diff-1:GOTO137
0
 1340IFtries=3 ANDok=tries diff=diff+1:GOTO1370
 1350IFtries=3 tries=0:ok=0:ENDPROC
 1360ENDPROC
 1370tries=0:ok=0:IFdiff<1 diff=1
 1380IFdiff>9 diff=9
 1390IFs FORI=1TO5:SOUND1,-11,220,1:SOUND2,-11,223,1:PR
OCdl(300):NEXT
 1400PROCclear3:PROCdl(1000):COLOUR2:PRINTTAB(28,28)"Di
fficulty":PRINTTAB(28,29)"level = ";10-diff
 1410ENDPROC
 1420IFopt=2 n1=RND(10):n2=RND(10) ELSEn1=RND(49):n2=RN
D(49)
 1430sign$=" plus ":cans=n1+n2:RETURN
 1440REPEAT IFopt=2 n1=RND(10):n2=RND(10) ELSE n1=RND(9
0):n2=RND(90)
 1450UNTILn1>n2
 1460sign$=" minus ":cans=n1-n2:RETURN
 1470IFopt=2 n1=RND(9):n2=RND(9) ELSEn1=RND(12):n2=RND(
12)
 1480n2=RND(12):sign$=" times ":cans=n1*n2:RETURN
 1490n2=RND(12):IFopt=2 cans=RND(5) ELSEcans=RND(12)
 1500sign$=" "+CHR$224+" ":n1=n2*cans:RETURN
 1510DEFPROCsound
 1520PRINTTAB(7,10)"Do you want sound effects?";TAB(11,
13)"Answer 'Y' or 'N'.  ";
 1530REPEAT:s$=GET$:UNTILINSTR("YN",s$):*FX15,1
 1540PRINT;s$:PROCdl(1000)
 1550IFs$="Y" s=-1 ELSEs=0
 1560CLS:ENDPROC
 1570DEFPROCdl(dl):LOCALZZ
 1580*FX15,1
 1590ZZ=INKEY(dl/20):ENDPROC
 1600DEFPROCthrow(cthrow)
 1610X=30:Y=15:PRINTTAB(X,Y)STRING$(5,CHR$225):PRINTTAB
(X,Y+4)STRING$(5,CHR$225)
 1620FORI=1TO3:PRINTTAB(X,Y+I)CHR$225;SPC(3);CHR$225:NE
XT
 1630IFcthrow PROCdl(1000):GOTO1660
 1640PRINTTAB(27,21)"Press SPACE":*FX15,0
 1650ZZ=GET
 1660TIME=0:REPEAT:dice=RND(6):PRINTTAB(32,17);dice
 1670UNTILTIME>=200
 1680ENDPROC
 1690DEFPROCmovep
 1700IFPP+dice>64 ANDs SOUND1,-15,25,5
 1710IFPP+dice>64 COLOUR1:PROCclear1:PRINTTAB(29,10)"To
o big":PROCdl(1500):PROCclear1:ENDPROC
 1720COLOUR1
 1730IFs v=-11 ELSEv=0
 1740FORI=1TOdice:SOUND1,v,140,1:PRINTTAB(plx%(PP),ply%
(PP));out$:PP=PP+1:PRINTTAB(plx%(PP),ply%(PP));pl$:PROC
dl(1000):NEXT
 1750PP1=PP:PP=FNcheck(PP):IFs v=-15 ELSEv=0
 1760IFPP>PP1 FORS=1TO255STEP5:SOUND1,v,S,0:NEXT
 1770IFPP<PP1 FORS=255TO1STEP-5:SOUND1,v,S,0:NEXT
 1780IFPP=PP1 THEN1800
 1790PRINTTAB(plx%(PP1),ply%(PP1));out$:PRINTTAB(plx%(P
P),ply%(PP))pl$
 1800IFPP=64 ANDs SOUND1,1,70,50:PROCdl(6000) ELSEIFPP=
64PROCdl(1500)
 1810PROCboard:ENDPROC
 1820DEFFNcheck(n)
 1830IFn=5 n=23:=n
 1840IFn=21 n=39:=n
 1850IFn=28 n=36:=n
 1860IFn=30 n=3:=n
 1870IFn=35 n=49:=n
 1880IFn=32 n=48:=n
 1890IFn=40 n=24:=n
 1900IFn=42 n=38:=n
 1910IFn=44 n=52:=n
 1920IFn=55 n=59:=n
 1930IFn=62 n=51:=n
 1940=n
 1950DEFPROCmovec:LOCALZZ
 1960IFCP+dice>64 ANDs SOUND1,-15,25,5
 1970IFCP+dice>64 COLOUR1:PROCclear1:PRINTTAB(29,10)"To
o big":PROCdl(1500):ENDPROC
 1980COLOUR2:IFs v=-11 ELSEv=0
 1990FORI=1TOdice:SOUND1,v,40,1:PRINTTAB(plx%(CP)+1,ply
%(CP));out$:CP=CP+1:PRINTTAB(plx%(CP)+1,ply%(CP));com$:
PROCdl(1000):NEXT
 2000CP1=CP:CP=FNcheck(CP):IFs v=-15 ELSEv=0
 2010IFCP>CP1 FORS=1TO255STEP5:SOUND1,v,S,0:NEXT
 2020IFCP<CP1 FORS=255TO1STEP-5:SOUND1,v,S,0:NEXT
 2030IFCP=CP1 THEN2050
 2040PRINTTAB(plx%(CP1)+1,ply%(CP1));out$:PRINTTAB(plx%
(CP)+1,ply%(CP));com$
 2050IFCP=64 ANDs SOUND1,2,150,73:PROCdl(7500) ELSEIFCP
=64 PROCdl(1500)
 2060PROCboard:ENDPROC
 2070DEFPROCend1:PROCdl(1400):*FX15,0
 2080FORY=7TO8:PRINTTAB(14,Y)CHR$130CHR$141"YOU WIN":NE
XT
 2090IFCP>56 PRINTTAB(8,15)CHR$133"But it was a near th
ing":GOTO2170
 2100IFCP<40 PRINTTAB(9,15)CHR$133"BEEB was miles behin
d":GOTO2170
 2110FORY=15TO16:PRINTTAB(13,Y)CHR$133CHR$141"WELL DONE
":NEXT:GOTO2170
 2120DEFPROCend2:PROCdl(1400):*FX15,0
 2130FORY=7TO8:PRINTTAB(15,Y)CHR$130CHR$141"I WIN":NEXT
 2140IFPP>56 PRINTTAB(8,15)CHR$133"But it was a near th
ing":GOTO2170
 2150IFPP<40PRINTTAB(9,15)CHR$133"You were miles behind
":GOTO2170
 2160FORY=15TO16:PRINTTAB(13,Y)CHR$133CHR$141"BAD LUCK"
:NEXT
 2170PRINTTAB(5,18)CHR$130"Your final difficulty level
was ";10-diff
 2180PRINTTAB(8,20)"Press SPACE to run again"
 2190ZZ=GET:IFZZ<>32 finish=TRUE ELSEfinish=FALSE
 2200ENDPROC
 2210*FX11,50
 2220MODE7:REPORT:PRINT" at line ";ERL
```

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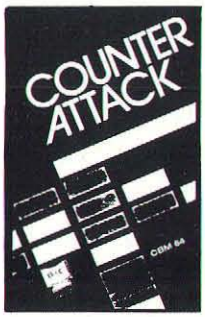

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EMS

OIC

Snackman

Margaret Stanger

Pack in whatever you are doing and stack up the points with the spritely Snackman.

This is my version of the familiar arcade game, in which Snackman is chased by three ghosts. I have used multicoloured graphics to improve the presentation, and to make it easier to animate the ghosts eyes and Snackman's mouth. The maze features a pen for the ghosts in the centre, and a power pill, or thunderbuster near each corner. There are two tunnels and they have openings halfway along each side.

When the score reaches a target of 500, Snackman can eat a fruit for bonus points. The fruit is chosen at random, instead of depending on the number of sheets cleared. This was done deliberately to encourage players who never normally get past the first sheet but could easily be modified.

DEVELOPMENT

I had hoped to use a 18 × 28 array to represent the maze, but as each element of the array took up four bytes of memory, it did not leave enough space for the rest of the program. Instead I set up a *BYTE ARRAY* , to represent the maze. Each byte represents a maze position, and contains the code for the picture to be POKEd on the screen.

When I first developed the program, I found that the computer took quite a long time to POKE the complete maze to the screen, because I was using FOR. . . .NEXT loops. The machine code routine was added, just to display the maze more quickly, but it could be replaced by a BASIC routine if preferred.

The first part of the program, SNACKMAN, reads in the data for the pictures and the maze and stores the information just below HIMEM. This part also assembles the machine code, displays instructions, and chains in the second part, Snackman.

VARIABLES

A%	Horizontal position of maze 'block'
B%	Vertical position of maze block
H%	Horizontal maze position, corresponds to 'PRINTTAB'
I%	Loop variable
J%	Loop variable
S%	Picture code
U%	Vertical maze position, corresponds to PRINTTAB
X%	Horizontal picture position
Y%	Vertical picture position
C	Loop variable used in demonstration
G	Ghost number in demonstration
P,PASS	Machine code assembly options
Q,Z	Used in delay routine
BLANK	&2CA0
PIC	&2CD0
&70,&71	contains the address of the first byte of the picture data
&75	MAZE
&77	SCREEN
&79	CODE
&80,&81	contains the address of the first byte of the screen location

DATA

LINE	CODE	PICTURE	ADDRESS (hex)
1790	0	Blank	2D00
1830	1	Snackman (Left)	2D20
1870	2	Snackman (Right)	2D40
1910	3	Snackman (Up)	2D60
1950	4	Snackman (Down)	2D80
1990	5	Yellow Ghost	2DA0
2030	6	Red Ghost	2DC0
2070	7	Green Ghost	2DE0
2110	8	Magenta Ghost	2E00
2150	9	Maze block	2E20
2190	10	Thunderbuster	2E40
2230	11	Dot	2E60
2270	12	Cherry	2E80
2310	13	Apple	2EA0
2350	14	Orange	2EC0
2390	15	Banana	2EE0
2430	16	Plum	2F00

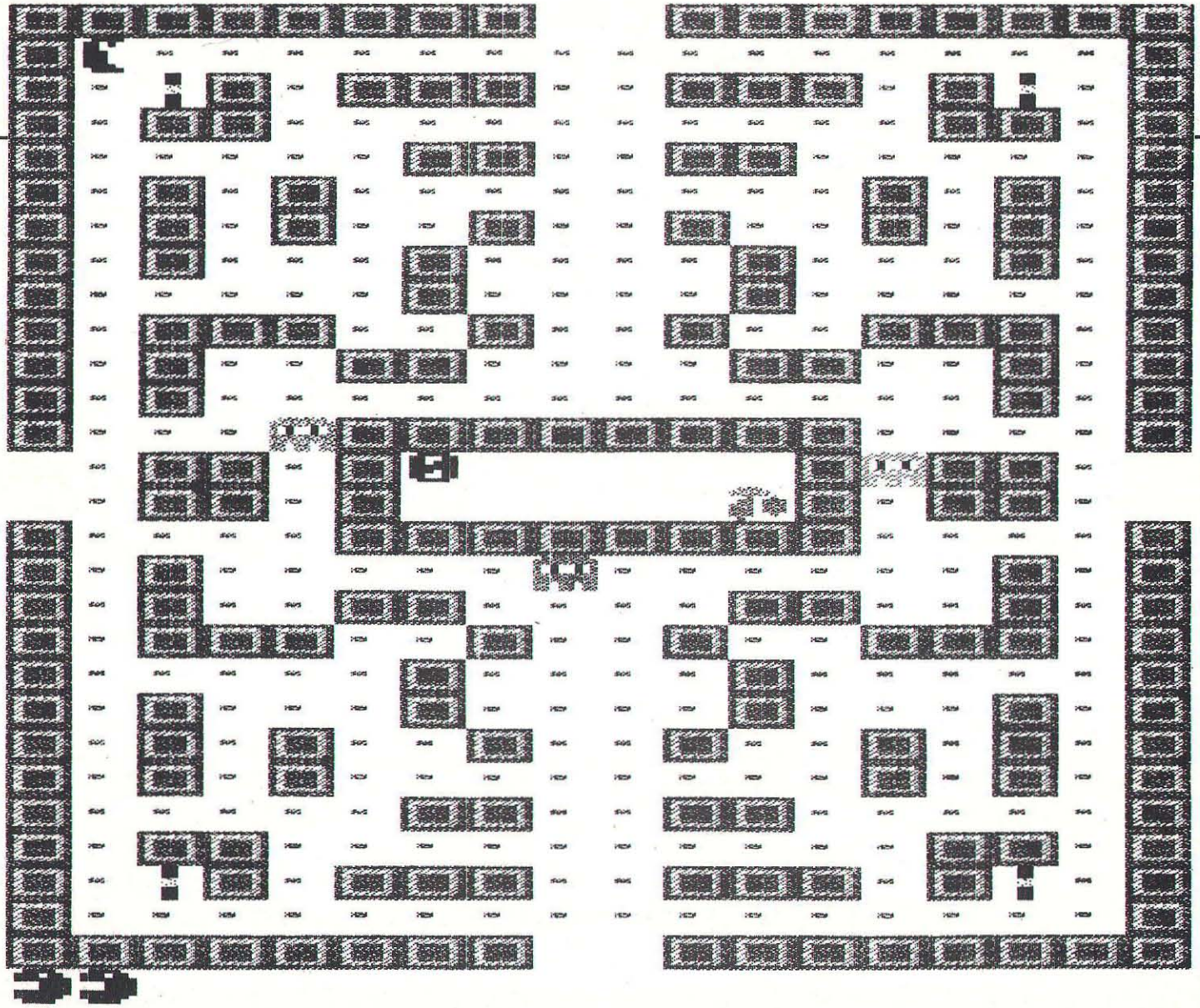
2470-2530 Coordinates of maze blocks in top left hand quarter

MAIN PROGRAM

50	Accesses initialisation procedure
60	Accesses procedure to print title and give short demonstration
70	Accesses instructions
80	CHAINs second part

PROCEDURES

100	PROCINIT
110	Takes Auto repeat off the keyboard
120,130	Sets the flash rate for the flashing colours to 15 centiseconds for the title sequence. Snackman is white on a black background. Part of his mouth is white/black and part black/white to simulate movement. The ghosts eyes move in a similar way.
140	Reads picture data into memory
150	Clears area of memory for maze byte array.
160,170	Puts blocks at sides of maze.
180	Puts blocks at to and bottom of maze.
190	Reads horizontal and vertical positions for blocks in top left corner, and puts corresponding blocks in other corners.
200	Assigns memory for two of the machine code routines.
210	Assembles machine code
230-320	Sets user defined characters
350	PROCAS assembles routines to POKE a picture, blank a picture, and display the maze
360-460	assembles PIC
470-570	Assembles BLANK
580-600	Assigns zero page locations for variables
610	Assembly options
620	Sets the program pointer to &D04. This routine is separate from the others as it was an afterthought. It is CALLed in PROCMAZE in part 2.
640,650	Sets the X and Y registers to the low byte and high



	byte of the number of elements in the maze.
660,670	Transfer registers to the stack
680-710	Compares maze element for block
720-780	Decides that element is a dot if it is not a block. This has the effect of replacing 'eaten' dots. Special areas can be cleared later.
	Put dot picture in &70
790	Puts dot code into maze element
800	Jumps to LOC
810-840	Puts block picture in &70
850-880	LOC puts screen position in &80
890	Pushes registers
900	POKEs picture
910	Pulls registers
920	Retrieves previous Y register
930-1000	Next screen position
1010-1060	Next maze position
1070	Decrease X register (Low byte of counter)
1080	Repeats loop if X Register not zero
1090	Decrease Y register (High byte of counter)
1100	Repeats loop if Y register not zero
1110	Returns to BASIC
1160	PROCPIC (X%,Y%,S%) POKEs picture of code S% at PRINTTAB positions X%, Y%
1220	PROCBLANK (X%, Y%) Blanks at X%,Y%
1270	PROCDELAY(Q) Delays for Q centiseconds if key not pressed
1310	PROCTITLE
1320-1360	Prints short introduction
1370-1380	POKEs Snackman and three ghosts
1390-1460	Shows ghosts chasing Snackman
1470	POKEs Snackman and yellow ghosts
1480-1550	Snackman chases ghosts

This demonstration could be omitted, but I found it useful in testing PIC and BLANK and some of the data.

1590	PROCINST Prints instructions of which keys

CONTINUED OVER

control the movement, and the score values

VARIABLES FOR SNACKMAN

F%	Fruit number
I%	Loop variable
J%	Loop variable
L%	Remaining lives
S%	Picture code
X%	Horizontal Picture co-ordinate
Y%	Vertical picture co-ordinate
A	Horizontal position
B	Vertical position
C	General 'scared' ghost flag
DX	Snackmans horizontal movement
DY	Snackmans vertical movement
D1	Distance of ghost1 from Snackman
D2	Distance of ghost2 from Snackman
D3	Distance of ghost3 from Snackman
F	Specific 'scared' ghost flg for the active ghost. Also used as the rank in the Top five routine
G1	'Scared' ghost flag for ghost1
G2	'Scared' ghost flag for ghost2
G3	'Scared' ghost flag for ghost3
g	Number of 'active' ghost
HI%	Hiscore
I	Loop variable
J	Loop variable
NGX	Horizontal new ghost position
NGY	Vertical new ghost position
Q	Loop variable
SC%	Score
T	Target level for fruit
TH	Remaining thunderbuster count
TL	Target level for extra life
W	Remaining dots or wafers
X	Horizontal position of snackman
Y	Vertical position of snackman
G$	Input string

ARRAYS

DGX(3)	Horizontal move of ghost
DGY(3)	Vertical move of ghost
GX(3)	Horizontal position of ghost
GY(3)	Vertical position of ghost
g(3)	Code of maze item under the ghost
SC%(5)	Top 5 scores
SC$(5)	Top 5 names

SNACKMAN

This part of the program plays the game, according to the instructions in the first half. When three lives have been lost, the top five scores are displayed before the game restarts.

MAIN PROGRAM

50	Sets mode, removes cursor
60	Accesses initialisation procedure
70	Accesses procedure to set the screen
80	Signals 'ready to move'
90	Plays the game by repeating the mans move and ghosts move forever.

If all three ghosts moved every time, the game was slowed down too much, so I arranged for the nearest ghost to become active and move, the other ghosts would just lurk.

PROCEDURES

130	PROCINIT
140	Minimises auto repeat on the keyboard
150,160	Alters the flash rate for the flashing colours
170	Frees the cursor keys for Snackmans left and right movement
180	Initialises variables
190	Defines labels
200	Dimensions arrays
210	Sets SC$ to maximum value. Puts initial values to in high score table. These values could be 'customised' but I have restricted the names to 10 letters to fit them on the scoreboard
240	PROCPIC (X%,Y%,S%) POKEs picture S% at X%, Y%
300	PROCBLANK (X%,Y%) Blanks at X%,Y%
350	PROCSETUP
360	Accesses procedure to display maze and characters
370	Displays scores and lives
400	PROCCHARS
410	Changes all the colours to blue to cover up the screen while the maze is being built up. (This line was preceded by 'REM' during program development
420	Replaces block at 2,28
430	Displays maze
440	Restores data pointer
450-460	Reads positions of blanks in the top left hand corner, and puts similar blanks in the other corners
470	Puts colours back to normal
490	Places thunderbusters
500	Places ghosts in pen
510	Places Snackman
520	Chooses fruit
530	Puts fruit on screen and in maze
540	Blanks ghosts in pen
550-570	Initialises ghosts and their movement
580	Initialises Snackmans movement
610	PROCSCORE-BOARD
620	Checks if the scoreboard has reached current target, and assigns an extra life up to a maximum of 9.
630,640	Prints lives
650	Starts again if score is more than 999,998 because there is no more space on the scoreboard. Unlikely, but possible
660	Updates hiscore
670	Prints score
680	Checks for clean sheet, resets the variables and sets up the maze
690	Checks if the score has reached the current target for fruit
700	Updates target, blanks fruit position in pen, and POKEs fruit in new position in maze
710	Stores item 'under' the fruit
720	Puts fruit in maze
740	PROCGHOST
750	Changes the ghosts back to normal if they are scored and their time is up.
760	Calculates which ghost is nearest Snackman. This could be replaced by g=RND(3) to make the game easier
770	Checks if active ghost is scared
780	Moves ghost
810	PROCMAN
820	POKEs last picture
830	Zeros snackmans movement
840	Upward movement
850	Downward movement
860	Right movement
870	Left movement
880	Left hand tunnel
890	Right hand movement
900	Top tunnel
910	Bottom tunnel
920	The code in

	snackmans new position defines what happens next
930	CODE 11,dot. Makes sound and updates score
940	CODE 10,thunderbuster. Makes sound updates score, accesses PROCCHANGE
950	CODE5,scared glutton. Makes sound, updates score, accesses PROCG to replace ghost.
960	CODES6-8,ghosts. Snackman is munched
970	CODES12-16,fruit. Checks for dot under fruit
980	Makes sound, updates score and fruit target and chooses new fruit
990	CODE0, blank. Updates position no change in score
1000	CODE 9,block and CODES 1-4, snackman No change in position
1020	PROCCHANGE
1030	Changes general and specific ghost flags
1040	Zeros the time
1050	POKEs ghosts in their new colour
1080	PROCBACK
1090	If all the ghosts have been eaten and replaced, the general flag only is changed
1100	Alters yellow to flashing blue and yellow
1110	Zeros all flags
1120	Yellow colour back to normal
1130	POKEs ghosts in new colour
1160	PROCMUNCH
1170	Sound cue
1180	Accesses PROCFADE
1190	Puts 'scared' ghost flags to normal
1200	Updates lives, checks for endgame
1210	Accesses PROCLIVES
1223,1230	Blanks Snackmans old position and puts him back in his corner
1240-1260	Puts previous code and picture in ghosts old position
1270-1290	Initialises ghost position, movement, and stores previous code
1300	Puts previous code in place of fruit
1330	PROCLIVES
1340	Short delay
1350	Blanks lives
1360	Updates score, sound cue
1390	PROCENDGAME
1400	Blue background, prints message and score
1410	Updates score
1420	Prints hiscore
1430	Prints header for Top 5
1440	Accesses Top 5 procedure
1450	Zeros variables
1460	Sets up maze for new game
1490	PROCG this procedure replaces the ghost after it has been eaten
1500-1520	Calculates ghost number. Puts specific 'sacred' flag to zero Adjusts number of dots for the dot under the ghost
1530	Updates stored code 'under' the ghost
1540	Puts ghost in new position in maze and POKEs its picture
1570	PROCCHASE
1580	Calculates new ghost position
1590	Checks for tunnel and changes direction
1600	What happens next is defined by code in the new position
1610	CODES 5-9, another ghost or a block. Accesses procedure to change direction next time. No move.
1620	CODES1-4, Snackman. If the ghost is not scared, accesses PROCMUNCH
1630	CODES10-16,dot, thunderbuster or fruit. Replaces picture from stored code from last position
1640	Updates stored code for new position
1650	Updates position and maze
1660	POKEs picture
1690	PROCDIR calculates the ghosts direction
1700	The horizontal component of the move is either zero or nearer Snackman
1710	Calculates vertical component of the move
1720	If both components are zero, a random movement is substituted. Note that the ghosts movement could be diagonal, as could Snackmans.
1770	PROCFADE
1780	Munching noise. User defined Snackman printed
1790	Prints fading Snackman
1800	Prints blank
1840	PROCMAZE
1870	Defines the position of the maze in memory
1880	Defines the top left hand corner of the maze on the screen
1890	Defines the first byte of the block picture
1900	CALLS machine code routine to display maze
1910	Tidies up the sides of the maze
1940	PROCTOPS
1950	Zeros rank
1960-1980	Finds the rank of the score
1990	Skips if score is not in Top 5
2000-2030	Shuffles down scores below new score
2040	Puts score at correct rank
2050	Prints other names and scores
2080	Empties keyboard buffer
2090	Goes to PROCNAME if score is in Top 5
2100	Prints message
2110	Waits for space bar to be pressed
2140	PROCNAME
2150	Clears SC$ and J(letter count)
2160	Prints message
2170	Prints score
2190	Takes Auto repeat off the keyboard
2200	Empties keyboard buffer
2210	Gets letter
2220	Adds letter to string
2230	Prints letter
2240	Adds 1 to letter count, or subtracts 1 in the case of a delete
2250	Until RETURN is pressed, ten letters are entered, or the user deletes past the start of the name
2260	Puts name in Top 5 at correct rank
2270	Minimises auto repeat on keyboard
2280	Sound signal

FUNCTIONS

1830	FNP(H%,U%) the maze position corresponding to coordinates H%,U%
2310	FNMIN decides which ghost is nearest Snackman
2320-2340	Calculates the distance of the ghosts from Snackman
2350-2380	Returns the number of the nearest ghost

CONTINUED OVER

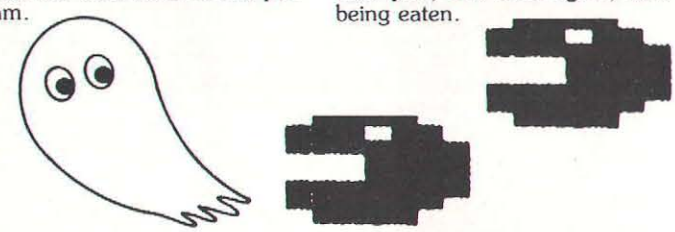
1750 Data for blanks in maze

CONCLUSION

In conclusion the program is too long to run on a Model A as it stands, but it RUNs on an Electron without modification. MODE 7 has not been used in this program.

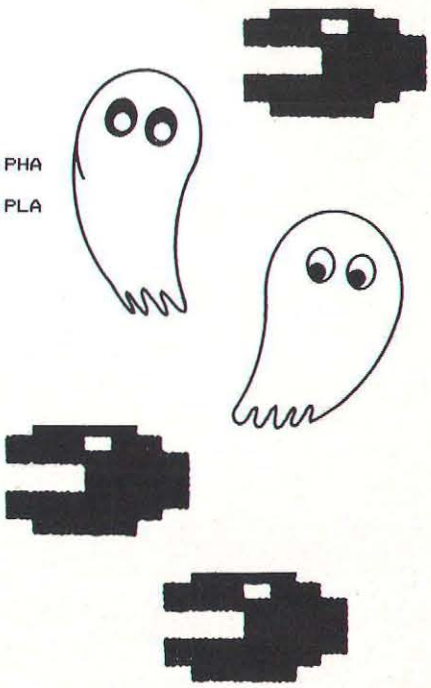
The maze could be improved by altering the data in part 1 that corresponds to the coordinates of the blocks.

The game itself could be improved by arranging for the ghosts to patrol the maze instead of chasing Snackman, as this is quicker to calculate. In this event the ghosts could wander back to their pen, and back again, after being eaten.



PROGRAM LISTING 1

```
  10MODE2:!&FE00=&10200A
  20REM***SNACKMAN**
  30REM******BY*****
  40REM**M.STANGER**
  50PROCINIT
  60PROCTITLE
  70PROCINST
  80CHAIN"Snackman"
  90:
 100DEFPROCINIT
 110*FX11,0
 120*FX9,15
 130*FX10,15
 140FOR X%=1TO 544:READ V%:?(HIMEM-&300+X%)=V%:NEXTX%
 150FOR J%=0 TO 28:FOR I%=0 TO 19:?(FNP(I%,J%))=0:NEXT
:NEXT
 160FOR J%=1 TO 28
 170?(FNP(1,J%))=9:?(FNP(18,J%))=9:NEXT
 180FOR I%=1 TO 18:?(FNP(I%,1))=9:?(FNP(I%,28))=9:NEXT
 190FOR I%=1 TO 31:READ A%,B%:?(FNP(A%,B%))=9:?(FNP(A%
,29-B%))=9:?(FNP(19-A%,29-B%))=9:?(FNP(19-A%,B%))=9:NEX
T
 200PIC=HIMEM-&330:BLANK=HIMEM-&360
 210PROCAS
 220ENVELOPE2,1,5,-5,-5,50,25,25,0,0,0,1,126,126
 230VDU 23,224,0,&20,&40,&FF,&40,&20,0,0
 240VDU 23,225,0,&04,&02,&FF,&02,&04,0,0
 250VDU23,226,&3C,&76,&7F,&0F,&0F,&7F,&7E,&3C
 260VDU23,228,0,&81,&81,&C3,&FF,&FF,&7E,&3C
 270VDU23,229,0,0,&81,&C3,&FF,&FF,&7E,&3C
 280VDU23,230,0,0,0,&C3,&FF,&FF,&7E,&3C
 290VDU23,231,0,0,0,0,&FF,&FF,&7E,&3C
 300VDU23,232,0,0,0,0,0,&FF,&7E,&3C
 310VDU23,233,0,0,0,0,0,0,&7E,&3C
 320VDU23,234,&81,&42,0,0,0,0,&42,&81
 330ENDPROC
 340:
 350DEFPROCAS
 360FOR PASS=0 TO 2 STEP2
 370P%=PIC
 380[OPT 0
 390.PIC LDY#32
 400.LOOP LDA (&70),Y
 410DEY
 420STA (&80),Y
 430BNE LOOP
 440RTS
 450]
 460NEXTPASS
 470FOR PASS=0 TO 2 STEP2
 480P%=BLANK
 490[OPT 0
 500.BLANK LDY#32
 510.LOOP2 LDA #0
 520DEY
 530STA (&80),Y
 540BNE LOOP2
 550RTS
 560]
 570NEXTPASS
 580MAZE=&75
 590SCREEN=&77
 600CODE=&79
 610FOR P=0 TO 2 STEP2
 620P%=&D04
 630[OPT P
 640LDX#48
 650LDY#3
 660.LOOP
 670TYA:PHA
 680LDY#0
 690LDA(MAZE),Y
 700CMP#9
 710BEQ BLOCK
 720LDA CODE
 730CLC
 740ADC#64
 750STA&70
 760LDA CODE+1
 770ADC#0
 780STA&71
 790LDA#11:STA(MAZE),Y
 800JMP LOC
 810.BLOCK LDA CODE
 820STA&70
 830LDA CODE+1
 840STA&71
 850.LOC LDA SCREEN
 860STA&80
 870LDA SCREEN+1
 880STA&81
 890PHA:TXA:PHA:TYA:PHA
 900JSR PIC
 910PLA:TAY:PLA:TAX:PLA
 920PLA:TAY
 930LDA SCREEN
 940CLC
 950ADC#32
 960STA SCREEN
 970LDA SCREEN+1
 980ADC#0
 990STA SCREEN+1
1000LDA MAZE
1010SEC
1020SBC#1
1030STA MAZE
1040LDA MAZE+1
1050SBC#0
1060STA MAZE+1
1070DEX
1080BNE LOOP
1090DEY
1100BNE LOOP
1110RTS
1120]
1130NEXT
1140ENDPROC
1150:
```



```
1160DEFPROCPIC(X%,Y%,S%)
1170!&70=HIMEM-&300+32*S%
1180!&80=HIMEM+640*Y%+32*X%
1190CALL PIC
1200ENDPROC
1210:
1220DEFPROCBLANK(X%,Y%)
1230!&80=HIMEM+32*X%+640*Y%
1240CALL BLANK
1250ENDPROC
1260:
1270DEFPROCDELAY(Q)
1280Z=INKEY(Q)
1290ENDPROC
1300:
1310DEFPROCTITLE
1320COLOUR1:COLOUR 128:CLS
1330PRINTTAB(3,2);"S N A C K M A N"'"  +++++++++++++
+++"
1340COLOUR 6:PRINTTAB(0,7);"Help SNACKMAN find "'"the
wafers in the "'"maze and avoid the"'"ghosts"
1350COLOUR 3:PRINTTAB(0,12)"There is a fruit forhim wh
en he scores"'"500 points"
1360COLOUR 1:PRINTTAB(0,17);" If he eats a "':COLOUR8:
PRINT"   THUNDERBUSTER":COLOUR1:PRINT'" the ghosts beco
me"'" scared and edible"'" for a short time."
1370TIME=0:REPEAT
1380PROCPIC(5,28,1):FOR G=1 TO 3:PROCPIC(G-1,28,G+5):N
EXT
1390FOR C=5 TO 19
1400PROCBLANK(C-1,28)
1410PROCPIC(C,28,1):SOUND1,1,150,1:PROCDELAY(20)
1420FOR G=1 TO 3
1430Z=C-5:IF Z<0 Z=0
1440PROCBLANK(Z,28)
1450PROCPIC(G+Z,28,G+5):NEXT
1460NEXT
1470PROCPIC(19,28,2):FOR G=1 TO 3:PROCPIC(14+G,28,5):N
EXT
1480FOR C=19 TO 5 STEP-1
1490PROCBLANK(C+1,28)
1500PROCPIC(C,28,2):SOUND1,1,70,1:PROCDELAY(20)
1510FOR G=1 TO 3:
1520Z=C-6:IF Z<0 Z=0
1530PROCBLANK(Z+4,28)
1540PROCPIC(Z+G,28,5):NEXT
1550NEXT
1560UNTIL TIME>750
1570ENDPROC
1580:
1590DEFPROCINST
1600CLS
1610COLOUR3:PRINTTAB(7,0);"MOVE"
1620PRINTTAB(1,1);CHR$224;" left    ";CHR$225;" right"
1630PRINTTAB(1,2);"A up       Z down"
1640COLOUR 1:PRINTTAB(3,4);"SCORE"
1650PRINTTAB(12,4);"Points":COLOUR1
1660PROCPIC(5,6,11):PRINTTAB(13,6);"2"
1670PROCPIC(5,10,5):PRINTTAB(13,10);"100"
1680PROCPIC(5,8,10):PRINTTAB(13,8);"50"
1690FOR Z=1 TO 5
1700PROCPIC(5,2*Z+10,Z+11):PRINTTAB(13,2*Z+10);Z*100
1710NEXT
1720PRINTTAB(0,22);"Clean sheet  100"'
1730ENDPROC
1740:
1750DEF FNP(H%,V%)
1760=HIMEM-&380-H%-20*V%
1770:
1780:
1790DATA0,0,0,0,0,0,0,0
1800DATA0,0,0,0,0,0,0,0
1810DATA0,0,0,0,0,0,0,0
1820DATA0,0,0,0,0,0,0,0
1830DATA0,21,21,21,21,21,21,0
1840DATA63,42,42,63,63,63,63,63
1850DATA63,106,192,0,0,192,106,63
1860DATA0,128,128,0,0,128,128,0
1870DATA0,64,64,0,0,64,64,0
1880DATA63,149,192,0,0,192,149,63
1890DATA63,21,21,63,63,63,63,63
1900DATA0,42,42,42,42,42,42,0
1910DATA0,21,21,21,21,21,21,0
1920DATA127,127,127,127,21,21,63,63
1930DATA191,191,191,191,42,42,63,63
1940DATA0,42,42,42,42,42,42,0
1950DATA0,21,21,21,21,21,21,0
1960DATA63,63,21,21,127,127,127,127
1970DATA63,63,42,42,191,191,191,191
1980DATA0,42,42,42,42,42,42,0
1990DATA5,15,95,95,15,15,15,15
2000DATA15,15,64,64,15,15,5,5
2010DATA15,15,170,170,15,15,10,10
2020DATA10,15,133,133,15,15,15,15
2030DATA4,12,72,72,12,12,12,12
2040DATA12,12,127,127,12,12,4,4
2050DATA12,12,149,149,12,12,8,8
2060DATA8,12,174,174,12,12,12,12
2070DATA20,60,104,104,60,60,60,60
2080DATA60,60,127,127,60,60,20,20
2090DATA60,60,149,149,60,60,40,40
2100DATA40,60,190,190,60,60,60,60
2110DATA17,51,98,98,51,51,51,51
2120DATA51,51,127,127,51,51,17,17
2130DATA51,51,149,149,51,51,34,34
2140DATA34,51,187,187,51,51,51,51
2150DATA48,52,52,52,52,52,52,48
2160DATA48,60,48,48,48,48,60,48
2170DATA48,60,48,48,48,48,60,48
2180DATA48,56,56,56,56,56,56,48
2190DATA229,218,69,255,192,69,218,229
2200DATA21,159,181,175,133,181,159,21
2210DATA42,111,122,74,95,122,111,42
2220DATA218,229,138,192,255,138,229,218
2230DATA0,0,0,0,0,0,0,0
2240DATA0,0,0,3,0,0,0,0
2250DATA0,0,0,0,0,0,0,0
2260DATA0,0,0,0,0,0,0,0
2270DATA4,12,4,0,1,3,3,1
2280DATA12,12,12,5,2,3,3,2
2290DATA0,12,15,1,3,3,1,0
2300DATA0,0,0,2,3,3,2,0
2310DATA4,0,0,4,12,12,12,4
2320DATA12,12,4,12,12,3,3,12
2330DATA4,8,0,8,12,12,6,8
2340DATA0,0,0,0,0,0,0,0
2350DATA0,5,1,5,1,5,1,0
2360DATA11,7,11,7,11,7,11,7
2370DATA11,7,11,7,11,7,11,7
2380DATA0,2,10,2,10,2,10,0
2390DATA0,0,0,5,15,15,10,10
2400DATA0,0,15,12,13,10,0,0
2410DATA0,15,13,10,0,0,0,0
2420DATA0,15,0,0,0,0,0,0
2430DATA4,12,0,17,51,51,51,17
2440DATA12,12,8,34,34,34,34,0
2450DATA0,8,17,51,51,51,17,0
2460DATA0,0,0,34,34,34,0,0
2470DATA4,3,6,3,7,3,8,3
2480DATA3,4,4,4,7,5,8,5
2490DATA3,6,5,6,3,7,5,7,8,7
2500DATA3,8,7,8,7,9,3,10,4,10,5,10,8,10
2510DATA3,11,6,11,7,11,3,12
2520DATA6,13,7,13,8,13,9,13
2530DATA3,14,4,14,6,14
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CONTINUED OVER

PROGRAM LISTING 2

```
  10REM***************
  20REM* Snackman by *
  30REM* M.STANGER   *
  40REM***************
  50MODE2:!&FE00=&10200A
  60PROCINIT
  70PROCSETUP
  80VDU7
  90REPEAT:PROCMAN:PROCGHOST
 100UNTIL FALSE
 110END
 120:
 130DEFPROCINIT
 140*FX11,1
 150*FX9,50
 160*FX10,50
 170*FX4,1
 180X=2:Y=2:T=500:TH=4:W=275:C=0:G1=0:G2=0:G3=0:L%=2:S
C%=0:HI%=0:TL=5000
 190PIC=HIMEM-&330:BLANK=HIMEM-&360
 200DIMGX(3):DIMGY(3):DIM g(3):DIMDGX(3):DIMDGY(3):DIM
SC%(5):DIM SC$(5)
 210FORJ=1 TO5:SC%(J)=1000:SC$(J)="..........":NEXT:SC
$=STRING$(10," ")
 220ENDPROC
 230:
 240DEFPROCPIC(X%,Y%,S%)
 250!&70=HIMEM-&300+32*S%
 260!&80=HIMEM+640*Y%+32*X%
 270CALL (HIMEM-&330)
 280ENDPROC
 290:
 300DEFPROCBLANK(X%,Y%)
 310!&80=HIMEM+32*X%+640*Y%
 320CALL (HIMEM-&360)
 330ENDPROC
 340:
 350DEFPROCSETUP
 360PROCCHARS
 370PROCSCOREBOARD
 380ENDPROC
 390:
 400DEFPROCCHARS
 410FORI=0 TO 15:VDU19,I,4,0,0,0:NEXT
 420?(FNP(2,28))=9
 430PROCMAZE
 440RESTORE
 450FOR I%=1 TO5
 460READ A,B:?(FNP(A,B))=0:PROCPIC(A,B,?(FNP(A,B))):?(
FNP(A,29-B))=0:PROCPIC(A,29-B,?(FNP(A,29-B))):?(FNP(19-
A,29-B))=0:PROCPIC(19-A,29-B,?(FNP(19-A,29-B))):?(FNP(1
9-A,B))=0:PROCPIC(19-A,B,?(FNP(19-A,B))):NEXT
 470VDU20
 480:
 490PROCPIC(3,3,10):?(FNP(3,3))=10:PROCPIC(16,3,10):?(
FNP(16,3))=10:PROCPIC(3,26,10):?(FNP(3,26))=10:PROCPIC(
16,26,10):?(FNP(16,26))=10
 500FORI=1 TO 3:PROCPIC(7+I,15,5+I):NEXT
 510PROCPIC(2,2,1):?(FNP(2,2))=1
 520F%=RND(5)
 530PROCPIC(12,15,11+F%):?(FNP(12,15))=11+F%
 540FORI=1 TO 3:PROCBLANK(7+I,15):NEXT:S%=1
 550PROCPIC(5,14,6):?(FNP(5,14))=6:GX(1)=5:GY(1)=14:g(
1)=11:DGX(1)=0:DGY(1)=-1
 560PROCPIC(14,14,7):?(FNP(14,14))=7:GX(2)=14:GY(2)=14
:g(2)=11:DGX(2)=-1:DGY(2)=0
 570PROCPIC(9,17,8):?(FNP(9,17))=8:GX(3)=9:GY(3)=17:g(
3)=11:DGX(3)=0:DGY(3)=-1
 580VDU 20:DX=0:DY=0
 590ENDPROC
 600:
 610DEFPROCSCOREBOARD
 620IF SC%>TL TL=TL+5000:IF L%<9 L%=L%+1
 630IF L%=0 GOTO650
 640FORI=1 TO L%:PRINTTAB(I,29);CHR$226:NEXT
 650IF SC%>999998 PRINTTAB(7,14);"STRING$(6," "):SC%=S
C%-1000000
 660IF HI%<>0 PRINTTAB(11,29);HI%
 670PRINTTAB(7,14);SC%
 680IF(W<1 AND TH<1)PROCPIC(X,Y,S%):W=275:TH=4:SOUND1,
2,0,50:?(FNP(X,Y))=0:X=2:Y=2:SC%=SC%+100:S%=1:C=0:G1=0:
G2=0:G3=0:PROCSETUP
 690IF SC%<T ENDPROC
 700T=T+500:PROCBLANK(12,15):PROCPIC(12,17,F%+11)
 710g(0)=?(FNP(12,17))
 720?(FNP(12,17))=11+F%:ENDPROC
 730:
 740DEFPROCGHOST
 750IF C=1 AND TIME>1000+100*(RND(10)) PROCBACK
 760g=FNMIN
 770IF C=0 OR (g=1 AND G1=0) OR (g=2 AND G2=0) OR (g=3
 AND G3=0) F=0 ELSE F=-g
 780PROCCHASE
 790ENDPROC
 800:
 810DEFPROCMAN
 820PROCPIC(X,Y,S%)
 830DX=0:DY=0
 840IF INKEY(-66) DY=-1:S%=3
 850IF INKEY(-98) DY=1:S%=4
 860IF INKEY(-122) DX=1:S%=1
 870IF INKEY(-26) DX=-1:S%=2
 880IF X+DX=0 ?(FNP(X,Y))=0:PROCBLANK(X,Y):X=18:?(FNP(
X,Y))=S%:PROCPIC(X,Y,S%):ENDPROC
 890IF X+DX=19 ?(FNP(X,Y))=0:PROCBLANK(X,Y):X=1:?(FNP(
X,Y))=S%:PROCPIC(X,Y,S%):ENDPROC
 900IF Y+DY=0 ?(FNP(X,Y))=0:PROCBLANK(X,Y):Y=28:?(FNP(
X,Y))=S%:PROCPIC(X,Y,S%):ENDPROC
 910IF Y+DY=29 ?(FNP(X,Y))=0:PROCBLANK(X,Y):Y=1:?(FNP(
X,Y))=S%:PROCPIC(X,Y,S%):ENDPROC
 920ON ?(FNP(X+DX,Y+DY))+1 GOTO 990,1000,1000,1000,100
0,950,960,960,960,1000,940,930,970,970,970,970,970
 930W=W-1:SOUND1,1,170,1:SC%=SC%+2:PROCSCOREBOARD:GOTO
990
 940SOUND1,2,5,5:TH=TH-1:SC%=SC%+50:PROCCHANGE:PROCSCO
REBOARD:GOTO990
 950SOUND1,2,100,5:SC%=SC%+100:PROCSCOREBOARD:PROCG:GO
TO990
 960PROCMUNCH:ENDPROC
 970IF g(0)=11 W=W-1:g(0)=0
 980SOUND1,2,50,5:SC%=SC%+F%*100:T=T+F%*100:?(FNP(12,1
7))=0:PROCSCOREBOARD:F%=RND(5):PROCPIC(12,15,11+F%)
 990 PROCBLANK(X,Y):?(FNP(X,Y))=0:X=X+DX:Y=Y+DY:?(FNP(
X,Y))=S%:PROCPIC(X,Y,S%):ENDPROC
1000ENDPROC
1010:
1020DEFPROCCHANGE
1030C=1:G1=1:G2=1:G3=1
1040TIME=0
1050FOR I=1 TO 3:PROCPIC(GX(I),GY(I),5):?(FNP(GX(I),GY
(I)))=5:NEXT
1060ENDPROC
1070:
1080DEFPROCBACK
1090 IF G1=0 AND G2=0 AND G3=0 C=0: ENDPROC
1100VDU19,3,11,0,0,0:SOUND0,2,6,40:FOR Q=1 TO2000:NEXT
1110C=0:G1=0:G2=0:G3=0
1120VDU20
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1130FOR I=1 TO 3:PROCPIC(GX(I),GY(I),I+5):NEXT
1140ENDPROC
1150:
1160DEFPROCMUNCH
1170SOUND0,-15,6,10
1180PROCFADE
1190C=0:G1=0:G2=0:G3=0
1200L%=L%-1:IF L%<0 PROCENDGAME:ENDPROC
1210PROCLIVES
1220?(FNP(X,Y))=0:X=2:Y=2:?(FNP(X,Y))=1
1230PROCPIC(X,Y,1)
1240FOR g=1 TO 3
1250?(FNP(GX(g),GY(g)))=g(g):PROCPIC(GX(g),GY(g),g(g))
1260NEXT
1270PROCPIC(5,14,6):g(1)=?(FNP(5,14)):GX(1)=5:GY(1)=14
:DGX(1)=0:DGY(1)=-1
1280PROCPIC(14,14,7):g(2)=?(FNP(14,14)):?(FNP(14,14))=
7:GX(2)=14:GY(2)=14:DGX(2)=-1:DGY(2)=0
1290PROCPIC(9,17,8):g(3)=?(FNP(9,17)):?(FNP(9,17))=8:G
X(3)=9:GY(3)=17:DGX(3)=0:DGY(3)=-1
1300IF ?(FNP(12,17))>11 ?(FNP(12,17))=g(0):PROCPIC(12,
17,?(FNP(12,17))):PROCPIC(12,15,11+F%):?(FNP(12,15))=11
+F%
1310ENDPROC
1320:
1330DEFPROCLIVES
1340FOR Q=1 TO 2000:NEXT
1350PRINTTAB(0,29);STRING$(19," ")
1360PROCSCOREBOARD:VDU7
1370ENDPROC
1380:
1390DEFPROCENDGAME
1400VDU 19,0,4,0,0,0:COLOUR 6:CLS:PRINTTAB(0,1);"GAME
OVER_ SC ";SC%
1410IF SC%>HI% HI%=SC%
1420 PRINTTAB(4,26);"HI SCORE ";HI%
1430COLOUR 3:PRINTTAB(4,4);"*T*O*P****5*"
1440PROCTOP5
1450X=2:Y=2:T=500:TH=4:W=275:C=0:G1=0:G2=0:G3=0 :L%=2:
SC%=0:TL=5000
1460CLS:PROCSETUP
1470ENDPROC
1480:
1490DEFPROCG
1500IF GX(1)=X+DX AND GY(1)=Y+DY:G1=0:G=1:IF g(1)=11 W
=W-1
1510IF GX(2)=X+DX AND GY(2)=Y+DY:G2=0:G=2:IF g(2)=11 W
=W-1
1520 IF GX(3)=X+DX AND GY(3)=Y+DY:G3=0:G=3:IF g(3)=11
W=W-1
1530GX(G)=8+G:GY(G)=2:g(G)=?(FNP(GX(G),GY(G))):IF g(G)
<>11 g(G)=0
1540PROCPIC(GX(G),GY(G),G+5):?(FNP(GX(G),GY(G)))=5+G
1550ENDPROC
1560:
1570DEFPROCCHASE
1580NGX=(GX(g)+DGX(g)):NGY=(GY(g)+DGY(g))
1590IF 1<NGX AND 18> NGX AND1< NGY AND 28>NGY GOTO1600
ELSE GOTO1610
1600ON ?(FNP(NGX,NGY))+1 GOTO 1630,1620,1620,1620,1620
,1610,1610,1610,1610,1610,1630,1630,1630,1630,1630,1630
,1630
1610PROCDIR:ENDPROC
1620IF F=0 PROCMUNCH:ENDPROC ELSE ENDPROC
1630?(FNP(GX(g),GY(g)))=g(g):IF g(g)=0 PROCBLANK(GX(g)
,GY(g)) ELSE PROCPIC(GX(g),GY(g),g(g))
1640g(g)=?(FNP(NGX,NGY))
1650 GX(g)=GX(g)+DGX(g):GY(g)=GY(g)+DGY(g):?(FNP(GX(g)
,GY(g)))=5+g+F
1660PROCPIC(GX(g),GY(g),5+g+F)
1670ENDPROC
1680:
1690DEFPROCDIR
1700IF RND(2)=1 DGX(g)=-SGN(GX(g)-X) ELSEDGX(g)=0
1710IF RND(2)=1 DGY(g)=-SGN(GY(g)-Y) ELSEDGY(g)=0
1720IF DGX(g)=0 AND DGY(g)=0 DGX(g)=2-RND(3):DGY(g)=2-
RND(3)
1730ENDPROC
1740:
1750DATA7,14,8,14,9,14,1,14,9,1
1760:
1770DEFPROCFADE
1780SOUND1,1,100,1:PRINTTAB(X,Y);CHR$(226);:FORQ=1 TO
1000:NEXT
1790 FOR I=1 TO 7:SOUND1,1,104+4*I,1:PRINTTAB(X,Y);CHR
$(227+I);:FORQ=1 TO 200:NEXT:NEXT
1800PRINTTAB(X,Y);" ":SOUND1,1,200,1
1810ENDPROC
1820:
1830DEF FNP(H%,V%)
1840=HIMEM-&380-H%-20*V%
1850:
1860DEFPROCMAZE
1870!&75=HIMEM-&380-20
1880!&77=HIMEM+640
1890!&79=HIMEM-&300+288
1900CALL &D04
1910FOR J=1 TO 28:PROCBLANK(0,J):?(FNP(0,J))=0:PROCBLA
NK(19,J):?(FNP(19,J))=0:NEXT
1920ENDPROC
1930:
1940DEFPROCTOP5
1950F=0
1960FOR I=5 TO 1 STEP-1
1970IF SC%>SC%(I) F=I
1980NEXT
1990IF F=0 OR F=5 GOTO2040
2000FOR I=4 TO F STEP-1
2010SC%(I+1)=SC%(I)
2020SC$(I+1)=SC$(I)
2030NEXT
2040SC%(F)=SC%:FOR I=1 TO 5
2050PRINTTAB(1,3+4*I);SC%(I);
2060IF F<>I PRINTTAB(10,3+4*I);SC$(I)
2070NEXT
2080*FX15,0
2090IF F<>0 PROCNAME
2100COLOUR7:PRINTTAB(0,29);"Press SPACE to go on":COLO
UR 3
2110REPEAT:UNTIL GET=32
2120ENDPROC
2130:
2140DEFPROCNAME
2150J=0:SC$=""
2160COLOUR7:PRINTTAB(0,29);"Enter Name & RETURN":COLOU
R 3
2170PRINTTAB(10,3+4*F);
2180REPEAT
2190*FX11,0
2200*FX 15,0
2210G$=GET$
2220SC$=SC$+G$
2230PRINTG$;
2240IF ASC(G$)=&7F J=J-1 ELSE J=J+1
2250UNTIL ASC(G$)=13 OR J=10 OR J<1
2260SC$(F)=SC$
2270*FX11,1
2280VDU7
2290ENDPROC
2300:
2310DEFFNMIN
2320D1=ABS(X-GX(1))+ABS(Y-GY(1))
2330D2=ABS(X-GX(2))+ABS(Y-GY(2))
2340D3=ABS(X-GX(3))+ABS(Y-GY(3))
2350IF D1<D2 AND D1<D3 g=1
2360IF D2<D1 AND D2<D3 g=2
2370IF D3<D1 AND D3<D2 g=3
2380=g
```

Processor Progress

Mark Webb

Progressing into 6502 and Z80 second processors plus the Bitstik CAD system.

The 6502 second processor has been a long time coming especially since Acorn have always seen second processor expansion through the Tube as the natural course to follow with the BBC Microcomputer system. It seems that the time consuming development of the Electron took its toll and when Acorn had to decide on its priorities for the latter half of 1983 then the Electron was deemed the more important project. Even now the manufacture of 6502 second processors is purely fulfilling back orders.

The actual launch of the unit was back in mid March when great emphasis was put on the combination of second processor and Bit Stik Computer Aided Design System. The number of back orders at least indicates that BBC system owners visualise the second processor as a useful addition in itself and it is perhaps best to consider it as a separate unit. It offers users considerable extra memory (RAM) and higher speeds of operation.

The plastic moulding which houses the second processor is the unit now familiar from the Teletext adaptor and IEEE interface and this case with its BBC 'profile' is obviously to become standard. It contains its own integral power supply with on/off switch at the back.

PLUGGING IN

Acorn have rather forced the positioning of the second processor alongside the BBC by supplying a ridiculously short ribbon cable (does it have to be this short?). This plugs into the Tube, the furthest right-hand port in the Beeb underbelly.

Almost the only way of making the connection with the BBC and second processor upright is to get down on your knees and pull the front ends so that they jut out over the edge of the desk/table top, giving access to the cable and male connector. It's also a good idea to put a book or other weight on the second 6502 unit since it's pretty light and may decide to topple over.

I suppose it's all part of the fun of setting up a new combination but is it necessary and what if you really would like to have the second processor tidied away from the keyboard? Certainly if you invest in a number of Acorn add-ons you are going to need a long bench and more cable.

The first element in getting your 6502 second processor up and running is to make the necessary changes to your BBC Micro, soon to be a mere I/O processor. The standard BASIC in your machine will run the system but to gain the full benefit of the extra memory available you will have to install the supplied ROM with Hi-BASIC. This places BASIC in the most memory efficient (from the point of view of BASIC program space) position. Hi-BASIC sits directly below the 2nd processor operating system, grabbing back the 14K which is left between the O.S. and normal BASIC located at &C00.

The Acorn Manual has an excellent Appendix on installing the new BASIC and it is a simple matter to fit both standard and Hi-BASIC to facilitate the use of the second processor and the BBC on its own.

The second installation involves the DNFS. As the initials indicate this is the combined DFS (1.2) and Econet (3.50). More importantly this ROM also contains the Tube software which is copied into pages four to seven of the I/O processor (the BBC). This occurs on power up. At the same time the second processor OS is copied from a ROM inside the second processor to &F800-&FFFF. The language ROM (VIEW, PASCAL or BASIC for instance) is copied to &8000-&C000, except Hi-BASIC as mentioned above. Having reconstructed your I/O processor with its new components safely installed, the system is ready to go. Once the BBC, then the second processor, have been switched on, a CTRL-BREAK reset brings up the role call, including our Tube 6502 64K. Switching back involves turning off the second processor and CTRL-BREAK once again.

MAKING ARRANGEMENTS

When the most flexible installation option is taken (ie standard and Hi-BASIC) it is important to note the number of the socket in which the Hi-BASIC has been put since on power-up the standard BASIC will take priority and Hi will have to be specified with a * FX142, followed by the socket number. You will always be able to check that Hi-BASIC is working by checking that HIMEM is at &B800.

A further alternative is to save Hi-BASIC to disc, leaving you another ROM socket free and allowing you to Boot up into BASIC. This method can be combined with the extended * command facility whereby the operating system will look for a disc file if it does not come across a suitably named paged ROM. Thus it is possible to build a library of programs which you might normally hold in ROMs (perhaps in a 16 socket board) on disc. Acorn give their permission to copy Acorn ROMs but warn against infringing the rights of the owner of the copyright of other programs.

Now that the second processor memory is available to the various filing systems it is important that they be able to recognise which is I/O memory and which belongs to the second processor. The solution used by Acorn is to number the I/O memory from &FFFF0000 to &FFFFFFFF. For the information required by the user (asked for with a * INFO or similar) the second processor memory locations are themselves prefixed with 00 to distinguish them from the parallel I/O locations prefixed with FF.

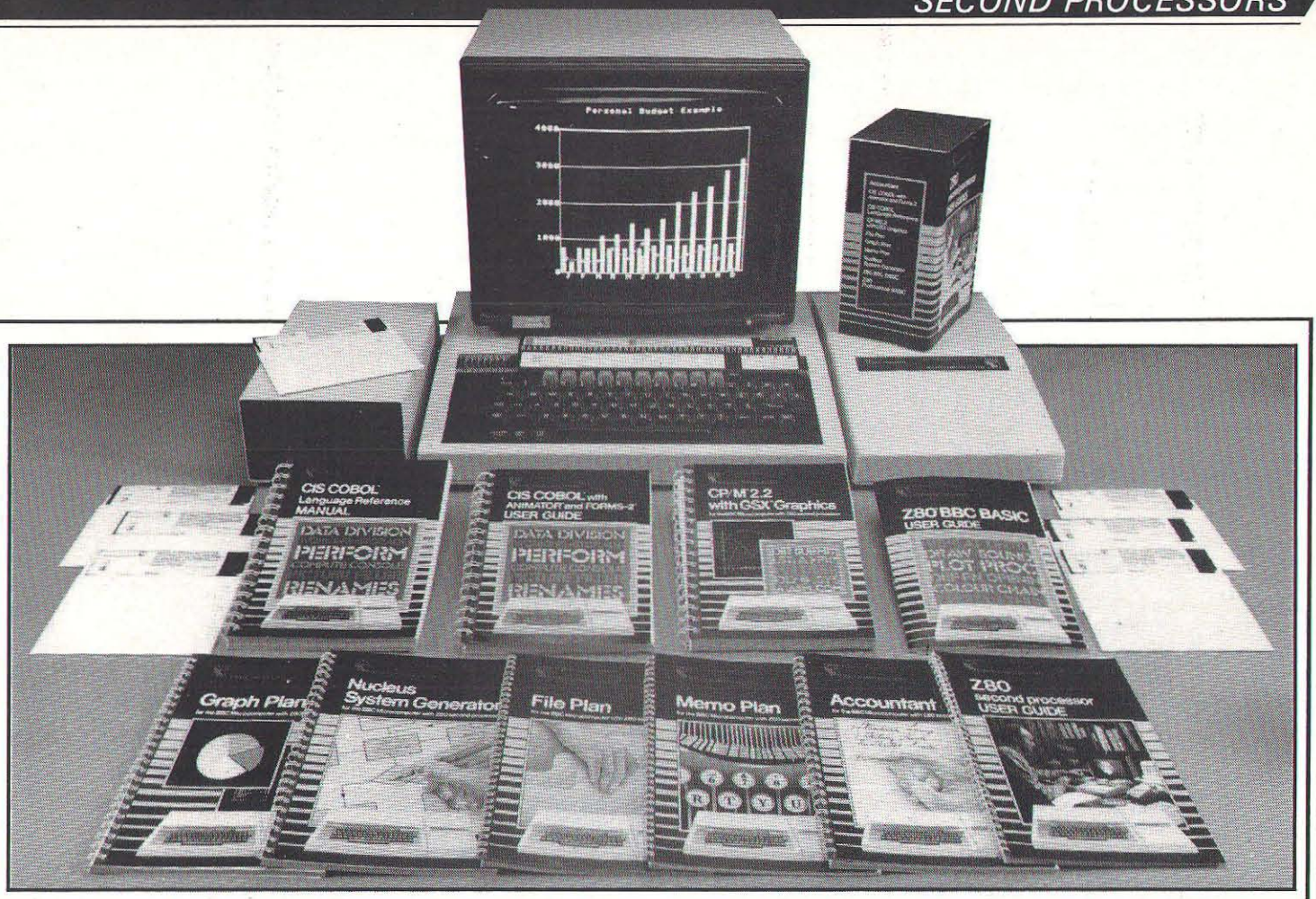
Using these conventions does make things clearer but it is important to recognise that they are only conventions and that it is only possible to directly access memory locations in the second processor RAM. Osword calls 5 and 6 are made available to read and write to I/O memory locations. The Acorn manual warns us off from the Tube hardware (first in first out buffers) addresses. These, it says, are 'read sensitive' and looking at any of the locations between &FEF8 to &FEFF could cause the system to crash. This is unlikely to stop people who are really interested disassembling the Tube software and finding out what Acorn have kept up their sleeves for so long.

The Tube provides a less than complete communication between the I/O and the second processor. When using assembly language O.S. calls are not possible inside an event routine. Osbyte calls 0 to 127 return a value only in the X register, high numbered calls return X, Y and carry flag. In general transmission of values across the Tube is done as economically as possible. Interrupts generated by devices outside the BBC Micro are not serviced by the second processor. Use of the second processor does tie the programmer down to some extent but all BASIC programs will encounter no trouble in making use of the second processor's extra speed and memory.

RUNNING IN

All programs that formally accessed screen memory directly will obviously fail because they will now be changing meaningless locations in the second processor. Games written using standard calls to O.S. routines will continue to operate. Many programs of course use a combination of both methods and work as far as they are within the rules and then stop dead.

Unfortunately most commercially produced software (with perhaps the exception of the educational sector) uses illegal (as far as the second pro-



cessor goes) methods and will have to be rewritten or dropped as far as the second processor is concerned. This should not cause too many sleepless nights either among users or software companies. Wordwise is the most popular application which could have put the extra memory to good use but will be unable to do so. Computer Concepts have gone for the Aries B-20 option to provide the extra memory and thus avoid this very problem.

The Aries B-20, Solidisk Sideways System and even random disc filing could be seen as (not necessarily cheaper) alternatives to a second 6502. However I think the Acorn second processor offers more to the user of BASIC software. For wordprocessing and spreadsheet operations the user is going to be rather straight-jacketed into using Acornsoft products but with a new improved version of View on the way that cannot be all bad.

The speed and memory aspects of the second processor come into play when we consider the number of useful application programs written in BBC BASIC. These programs have been written in BASIC because their creators are not 'expert' programmers but knowledgeable in the relevant topic. As these programs develop, speed and especially memory (the Beeb's 32K has to satisfy some greedy graphics modes) become a problem, the 6502 in the second processor box runs at 3Mhz which means that you can expect up to a 50% increase in speed over the ordinary BBC Micro.

This is at its most apparent when using colour fill routines such as the one to be encountered in the 'Europe' program listing in this issue of ***A&B***. The PLOTing is done very fast indeed and makes the map drawing time much more acceptable. Similarly with games written in BASIC in which characters are PRINTed to TAB(x,y) positions. Things become much more active.

WHO NEEDS IT?

The 44K available to the BASIC programmer, and the 60K to the assembly language programmer should remove to the archives that old nutmeg 'Bad Mode' encountered so many times by Beeb users when moving into the more insatiable graphics modes. In addition all I/O is now handled by the original 6502 leaving the second free to run the application program with very little hindrance from the Tube. You also have the use of a fully expanded character set without using up valuable memory. It all happens at the I/O end and leaves the processing power free to get on with it.

Who needs a 6502 second processor? I think the answer is anyone who needs that extra memory. Systems like the Bit Stik have to have the second processor to work and there is no doubt that more advanced hardware will be developed around it. Any normal BBC owner however who uses his/her machine for more than just games, and that means most, will gain considerable benefit from the second 6502, the usefulness of completing his/her business letter without having to file a portion of it and start again; the joy of watching a map drawn in half the time it used to take. At £199 I think the advantages of buying Acorn make it worth the money but obviously this is on condition that there is a good deal of use to be had out of it, ie if you intend to use the extended system as a shared resource or for profitable or time saving activities in business and around the home.

PROGRESS TO Z80

Of course if you intend to invest in a second processor for your BBC Micro system and you intend to use it primarily for business, then the Z80 option is now available from Acorn. It's attractively priced at £299 and bundled with '£3,000' worth of software, including everything you might need to control the financial side of a small to medium sized company.

Ironically Acorn, on the very day that the acquisition of Torch was announced, took their own product line into Torch business territory. Acorn are now doing with their Z80, what Torch have been doing for 18 months, following the "BBC route" into the consciousness of business users shopping for cheap computer systems. At the same time Acorn have completed the BBC Microcomputer system as originally planned.

The Z80 plugs into the Tube interface in the same awkward fashion as the 6502 and to all intense and purposes looks very much the same from the outside. The Z80B microprocessor used in the second board however provides considerably faster speeds than the old or new 6502. It runs at 6Mhz. Again the Tube allows communication between the BBC and Z80 with no discernible lag. The second processor also provides 55K of memory for BASIC programs and all impor-

CONTINUED OVER

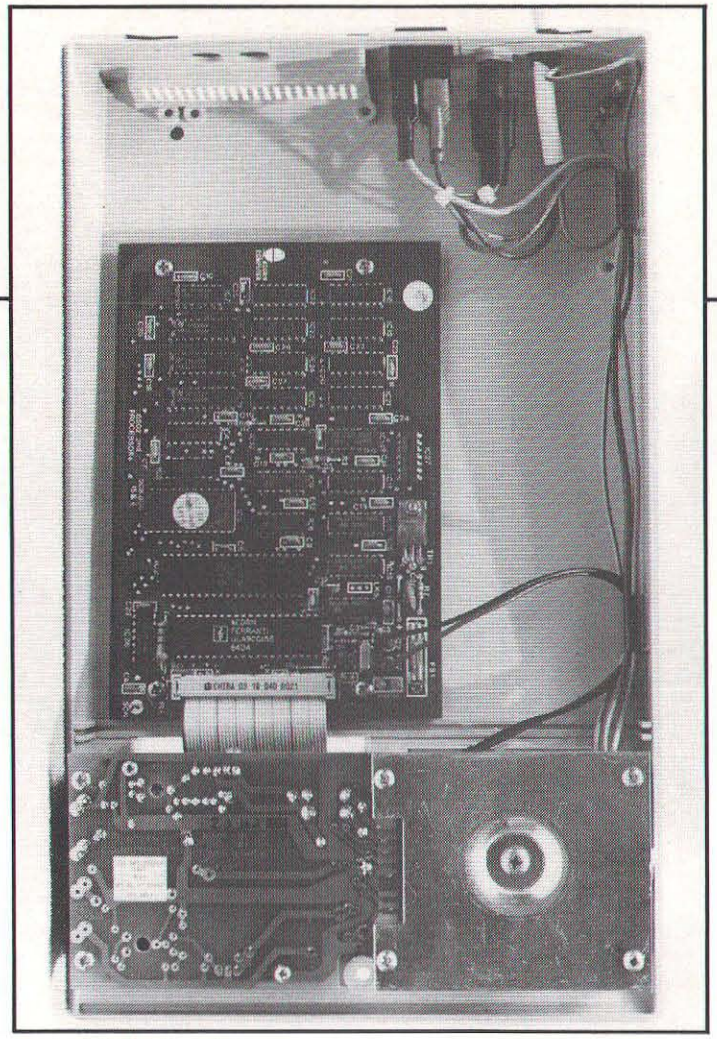
tant access to the wide world of CP/M. This disc operating system standard means that a considerable range of specialist business software will run without alteration on the BBC plus Z80 second processor.

As well as dealing with I/O duties as per the 6502, the old Beeb's RAM is also utilised for 'disc caching' which it is claimed improves disc access time. This is a necessary improvement where CP/M is concerned because the high speed of the BBC can be rendered useless by the need to continually access disc files and to manually locate discs in the correct drives and so on. The CP/M in question is version 2.2 which is a proven system though not the latest and allows full access to the MOS of the BBC.

AMAZING BASIC

It's an amazing aspect of the system (though perfectly natural) that any BBC BASIC programs developed on the 6502 based BBC Micro, will now run without alteration on the second processor. The BBC BASIC (Z80) by M-Tec is interpreted to drive the Z80B chip. the Z80 version of BBC BASIC is now available separately so that other computer users (perhaps those of the new Amstrad which will support CP/M) can benefit from this successful form of the standard BASIC. It even has a parallel Z80 assembler, with appropriate mnemonics, built in. The BBC with Z80 second processor thus becomes a very powerful development system.

The Tube and Acorn's obvious ability to design specifically for the architecture of the BBC means that the full benefit of a second processor is utilised. Acorn have gone out of their way to make full preparations for the new user, either new to business or new to computing. They have carefully selected the dealers who are to sell the Z80 system and have insisted that staff complete successfully a training course at their Maidenhead training centre. The software is documented in great detail with tutorial on how to use the program as well as advice on when and in what circumstances the software will prove beneficial, or not.



Second 6502 innards

PLANNING A BUSINESS

The 'Plan' series of business software provides office productivity programs, Memoplan (wordprocessor), File Plan (database) and GraphPlan (spreadsheet with graphic output). These units are fully integrated. Also provided is an integrated accounting system, Accountant, and the Nucleus System Generator which allows the non specialist to create application programs and which is winner of the 1984 RITA Software Product of the Year award.

There is a CIS COBOL, a standard commercial language, which won't do the educational sales of the Z80 system any harm. The BBC system surely offers the cheapest entry point for learning COBOL in schools and colleges. This version is specially designed for microcomputers. It also come with two programming aids, Animator, a visual debugging editor and Forms-2 which allows the programmer to create the desired screen and lets the utility get on with generating the COBOL source code.

There is also (the quality of these programs may as yet be an unknown factor but there is no doubting the quantity!) a 'Professional BASIC', a dialect similar to those of Microsoft and Digital Research and with extra functions that convert upper to lower case and search for strings.

Potentially the most exciting piece of software is the GSX-80 graphics system. It is the graphics extension of the CP/M family of operating systems, allowing graphics (usually uniquely created by individual machine) to be transported to other computers with GSX-80. The software makes the graphics capabilities of the BBC available to other CP/M programs, which is necessary in the world of business graphics, where hard copy output of visual aids are an important consideration.

As well as providing a 'starter pack' with their Z80 system, Acorn have contracted Software Ltd to configure its catalogue of CP/M packages for the BBC Z80 second processor. This is to ensure software compatibility with all the old favourites such as Wordstar, Dbase and Supercalc. Software Ltd will be distributing to Acorn dealers handling the Z80 system as the need arises.

At £299 and Z80 second processor and bundled software looks terrific value for money but a lot depends on the quality of the backup.

The hardware certainly seems to surpass expectations and the software shows great promise. ***A&B Computing*** will be looking in much greater detail at both in forthcoming issues. In the meantime if an Acorn dealer near you has passed his training exams and is stocking the Z80 package, it could well be an interesting visit and perhaps even a profitable one.

PROGRESSING TO CAD

Perhaps Acorn's emphasis at the 6502 launch on the combined system was not misplaced. The Bit Stik CAD system is one very good reason for getting hold of a 6502 second processor, without which it cannot function.

The Bit Stik system has been developed by Robocom and subsequently given the Acorn badge. The original version was implemented on the Apple microcomputer and has proved very successful with over 12,000 sold worldwide. The Apple uses the 6502 microprocessor, the same as the BBC and the BBC version of the software must have seemed the natural step for Robocom to take. There are obvious differences between the versions but Robocom claim to be happier with the BBC based system and it seems likely that they have improved on the original.

The Bit Stik CAD system relies entirely upon the right hardware being available. The second processor (6502) is requirement number one; dual eighty track double sided disc drives — the

most expensive option — are number two. It's not going to be the most portable of systems and as well as the lbs, it's also getting a bit heavy on the £s. Bit Stik does not bring CAD within your grasp unless you have a very healthy bank balance, a very friendly bank manager or a very profitable use to which the system can be put.

In monetary terms we are talking about £399 for your humble Beeb, £199 for the second processor, £375 for the Bit Stik, approaching £500 for the disc drives and whatever you are prepared to pay for a monitor (hi-res colour to get the full benefit). You will need between £1,500 and £2,000.

I think it fair to say then that we are looking towards the professional who is looking for a cheap CAD system,. Of course there are problems with buying into a cheap system, mainly concerning future expandability should the business take off and integration with more advanced systems. The Bit Stik is so economical however that in business terms there is no great outlay to worry about anyway. The actual availability of such a cheap system may inspire new ideas and enterprise around it. It will create its own market.

ELECTRONIC EASEL

The actual setting up of the Bit Stik system is straightforward enough if you are used to squeezing in those horrible nerve-racking ROMs. Typically the DNFS, Hi-BASIC and graphics ROM are all just that bit wider than the sockets into which they are to go. It is just a question of keeping your nerve and double checking. You will probably only have to do it once so it's worth taking a bit of time.

The optimum configuration for me was (reading from left to right) O.S., DNFS, empty, Bistick graphics, Hi-BASIC. If you want to run ordinary BASIC as well it gets a bit complicated and it may be necessary to call it up with a *FX call. plug the Bitstik into the A to D port and insert the System Master disc and Buffer disc and away we go.

The manual sensibly advises on making backups of the System Master and supplied library disc. There is also a considerable amount of space devoted to the ordinary and special formatting required for the buffer, library and archive discs. All this is carried out by the system.

The Master program is copied into memory from drive 0 and the disc replaced with the current library disc. Drive 0 is also used for archive discs, a special sort of long term library disc on which the CAD database is to be created. The buffer disc remains in drive 1 throughout (default state). The system menu offers formatting facilities palette changing and the special disc utilities for compacting and recovering (may it never be needed) library discs.

Naturally as beginners we go for the most interesting looking option: 'Run the graphics program'.

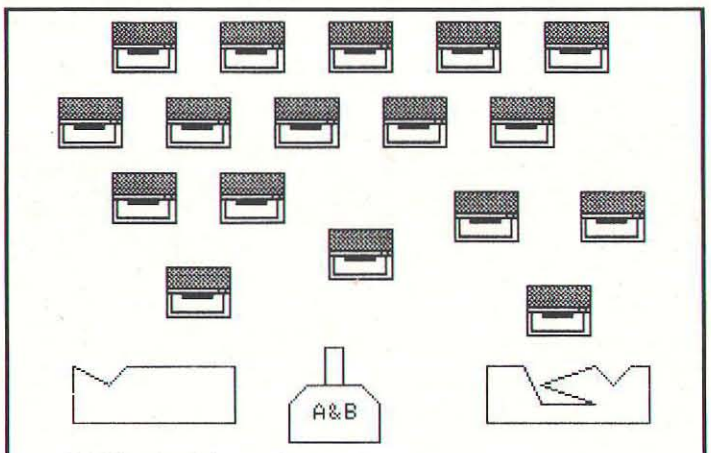
CONSISTENTLY FRIENDLY

The Bit Stik itself is very easy to use and I get the feeling that a lot of research and trial by error must have gone into creating the design because it made everything easy to accomplish, moving around the screen, making selections from the menu, and drawing and filling shapes. No one is going to suggest that the £347 which you will pay for this system gets you a great deal of hardware (much of the value is on those discs) but the one important human interface, the Bit Stik itself is a complete success.

The joystick component is smooth and responsive in the X,Y axis and the controller easy to turn between two fingers (this controls the Z axis or ZOOM). There are also three push buttons on the lower casing, left and right either side on the bottom and top, a red button, on the top left hand corner. Various combinations of these buttons select, deselect, and action all of the drawing, moving and filling options, as well as moving between menus and to and from library discs.

The great thing about the use of these three buttons throughout all the various functions which the system can perform is the consistency of use. Great care has been taken to ensure that you soon become conditioned into using a certain key for a certain type of action. This consistent use of L, R, T, Z as they are termed in the user guide, makes the system very user friendly very early on. An intelligent guess will usually find you the right button to select or activate the function you are looking for.

It is also clear that the minimum number of presses has been designed into the software. Where a complicated drawing procedure is called for as in locking angles, using and dispensing with grids and so on, then the tutorial section of the user guide takes you through the steps one by one explicitely telling you which button to press and when. When an important function like WIPE has been selected it takes two buttons, L and R pressed down at the same time to confirm and activate selection.



COPYing back in numbers

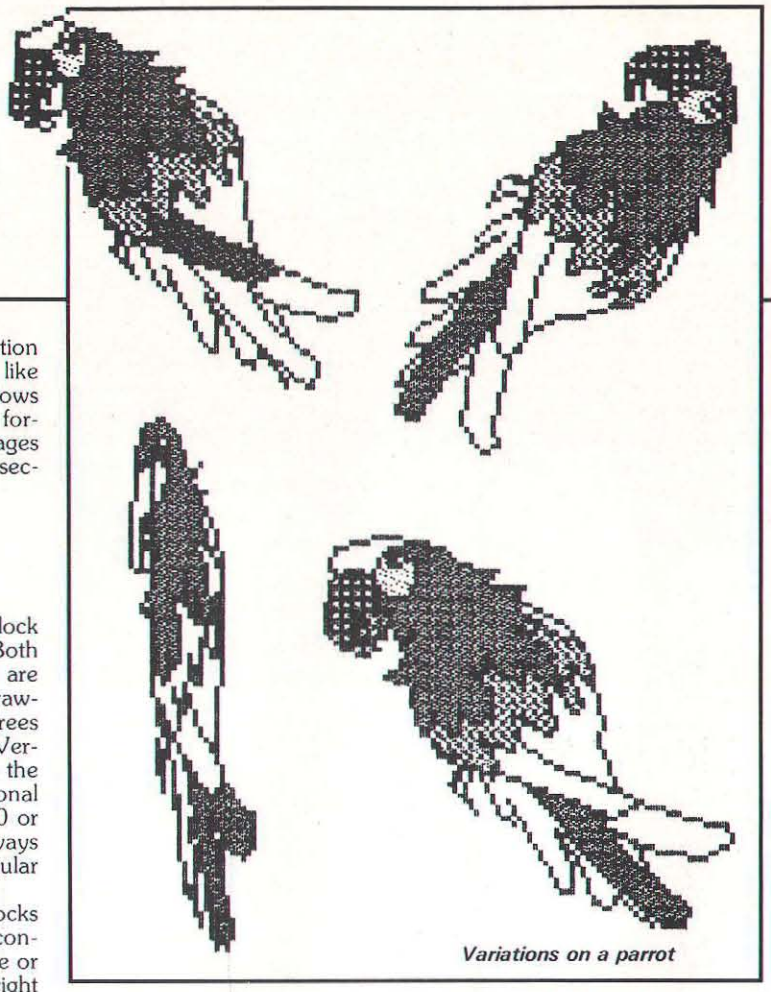
A LOT TO LEARN

There is a lot to learn when coming to the Bit Stik system new but the ability to practise from the outset and the excellence of the manual, with its tutorial and reference sections, makes learning easy. The one area where some former experience or training might be handy is in the use of Bitstik for technical drawing but once again there are so many aids, such as locks and grids, with high accuracy built into them (for instance the Vernier angle locks) that this would be the ideal system on which to start learning.

There are small touches of design of software which make it simpler and quicker to use than it might be. For instance, in the precision drafting functions, when you select a grid size with which to work in the X axis, the Y axis is also automatically changed to the same measurement, when touched by the cursor, thus dealing instantly with the most often encountered situation. Of course the 'press L, rotate Z' combination will change Y to any setting you require but the frustration of having to change both X and Y each time has been avoided. There are many such examples and cannot all be described here.

The different nibs, arc and circle drawing functions, 16 colour pallette with an instantaneous fill (PAINT), all would take a very long time to fully describe. Safe to say that they do allow most shapes and sizes to be drawn with ease. Each function has its own cursor shape which is positioned and manipulated using the Bitstik. When satisfied with the circle, ellipse, tangent, concentric or compass arc or perhaps the area you wish to shade with the chosen nib, then it is a simple

CONTINUED OVER



Variations on a parrot

matter of depressing T to action the function. If you don't like what you see then ERASE allows you to step backwards and forwards through the various stages of your drawing to select the section to be dispensed with.

GETTING TECHNICAL

Menu 2 offers two main lock functions, range and grid. Both have very wide facilities and are designed to aid precision drawing. You can choose the degrees and minutes precision of the Vernier lock or just degrees with the Coarse Angle Lock. Orthogonal locks give you unadjustable 0 or 90 degree lock axes, always useful for drawing rectangular structures.

The Normal Tangent locks are used to draw smooth continuations of any previous line or a line normal to it (at right angles). N-Tan automatically senses the slope of the last line and is thus very useful in blending curves into straight lines (the opposite function is performed by TAN-ARC).

N-TAN can also be used to rotate a grid. The grid facility is of boundless utility to the technical drawer, playing the part of conventional graph paper or transparent overlay. The grid appears as a matrix of lock points, to which the cursor is confined in its movement. There is a wide choice of grid size, from four to 32 pixels. 4, 8, 16 and 32 are best since they allow magnified views without shifting the grid origin. The are two preset grids which cannot be skewed or rotated, 8×6 and 8×8, both with their origin at the exact centre of the work page When using preset grids, both COPY and ZOOM work in quantised settings. Thus any drawings, perhaps an electronic component, can be copied to the work page with perfect registration and consistent size. ZOOMing to the available setting, 1:2, 1:16 for instance, gives a 'nested' structure of locked grids within the first preset grid allowing you to draw to precisely determined intermediate points. Angle and grid functions can be combined to produce highly accurate drawings. These drawings can of course be FILEd to library discs, as with freehand work to be COPied back onto the work page.

AT THE LIBRARY

Probably the most important facility provided by Bitstik is the ability to FILE the work page into a slot on your current library disc for later retrieval. Each library disc — there is one supplied with a number of example drawings — can be formatted to hold four or sixteen separate drawings, each an old work page. Obviously the library can be used as temporary storage but the COPY function does more than just retrieve the work page from store.

When you COPY back a library slot the COPY pallette appears at the bottom of the work page. The selected drawing is now ready to be planted at any point on the current work page using the COPY cursor. You can move the cursor in the X,Y axes; you can change scale using Z. With L depressed, Z will rotate the cursor. With R depressed, Z (the top of the Bitstik controller) will STRetch or squeeze the cursor frame. Percentage values of the original drawing are displayed on the screen so that a precise amount of stretch can be imparted. Similarly with ROTate and SCaLe. FLIP allows the planted drawing to be reproduced symetrically in both axes.

Although text entry from the keyboards is fairly limited, when COPYing text back from the library all the above facilities are available and as you can imagine, it is possible to come up with some pretty interesting typefaces.

When working with the powerful facilities of the Bistik it is important to remember what exactly is happening when you draw or fill something on the work page. The screen image is in effect only a window on the wider world of the work page which has a potentially enormous size. The pixel width of the screen is our only limitation on viewing this page.

There are two different levels of work, the bit-mapped screen and the inaccuracies which sometimes occur on it (it does not have infinite resolution) and the co-ordinates in which the software stores its version of the picture, which is entirely accurate. The memory used to store this information is not limitless and is indicated by a counter on the screen. It may be necessary with larger or more complex drawings to FILE the current page and then COPY back to resume work. This resets the available memory.

The ZOOM facility or PAN can take you around the whole creation but obviously the view remains limited by the size of the screen map/memory. It's a bit like looking through a telescope.

UTILISING BITSTIK

The Bitstik is only as good as the use you can make of it and the UTILS menu is designed to let you make use of the work page as seen through the screen. The screen display can be brought up to full size by removing the Menu and pallette overlays which are normally on display. The screen can then be saved as a bit map or printed out to a dot-matrix printer in various shades of grey. Another possible output might be through a photographic image of the screen but this is not the strong point of the Bitstik system as it stands although output to other devices such as a colour plotter is promised. There are now four-colour plotters for around the £400 mark and it is to be hoped that output to these will become standard since a black and white printout of the screen cannot do justice to this system.

The saving of screens opens up the possibility of video captioning and also means that screens can be reproduced away from the hardware dependent Bitstik system — a small industry selling screen artwork perhaps?

There is little point in comparing digitiser, joystick or tablet based systems with Bitstik. Anything available for the BBC is not in the same class. Individuals are not going to rush out and buy the system but as a shared resource in schools, colleges and businesses, Bitstik will prove amazing value. People will be queuing up to use it wherever the system is installed.

ROM SOFTWARE
for the BBC Micro

Print master

£33.35 incl.

PRINTMASTER is a printer utility ROM, offering powerful screendumps, text dumps, file dumps and many others. PRINTMASTER offers the best possible utilities, and plenty of them, for just one type of printer per ROM.

PRINTMASTER (EPSON) supports the MX, RX and FX series of printers.
PRINTMASTER (STAR) supports the STAR GEMINI 10X and the DP510.

Versions for other printers will be produced according to the volume of requests for each type.

All PRINTMASTER commands are preceded by an asterisk and can be used in the same way as Operating System commands, i.e. they may be included within BASIC programs as well as other languages etc. In addition, BASIC 'resident integer variables' may be passed to the commands within programs.

Just some of PRINTMASTER's commands are listed below:

*GDUMP will allow screen dumps of any mode. Mode 7 (TELETEXT) screens can be copied including double-height characters. All 16 colours are represented by graduated grey shading. The dump may be printed in any direction on the paper (horizontally or vertically) and can be magnified by any factor in length and height independently.

*WINDOW gives an interactive means of definining a graphics window, far easier than the normal VDU command. GDUMP will copy only the area within the graphics window.

*TDUMP copies any text currently on the screen.

*GPRINT will print a string of characters as large as necessary (e.g. one character per page!) in any orientation, shade, etc. for headings, posters, etc.

*FDUMP copies the contents of a file directly to the printer, whilst the machine is being used for other tasks, running programs etc.

Other commands include: *FONT, *UNDERLINE, *ITALICS, *TAB, *PAGELEN, *INITIALISE, *DEFINE, and others.

```
PRINTMASTER (Epson) 1.02
  DEFINE <chr>
  FDUMP (<fsp>)
  FONT <country>
  GDUMP (<or,op>) (<X,Y>) (<gap>)
  GPRINT <str> <X,Y> (<or,op>) (<gap>)
  INITIALISE
  ITALIC (<on/off>)
  LINCH <lines per inch>
  LINESPACE (<a>) (<b inches>)
  MARGIN (<left>) (<right/+width>)
  PAGELEN (<inches/+lines>) (<skip>)
  PCODE <codes/$ASCII>
  PROPORTION (<on/off>)
  STYLE <str>
  TAB <columns ...>
  TDUMP (<udc width>)
  TEXT (<width>) (<shade>) (<height>)
  TPRINT <str> <chr> (<X,Y>) (<or,op>)
  ULOAD (<fsp>)
  UNDERLINE (<on/off>)
  USAVE (<fsp>)
  WINDOW
  WVALS
OS 1.20
```

Now Available

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for the GEMINI 10X and the DP 510

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```
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(C) Computer Concepts 1982

1) Save entire text
2) Load new text
3) Save marked text
4) Load text to cursor
5) Search and Replace
6) Print text
7) Preview text
8) Spool text

ESC Edit Mode

Please enter choice_
```

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Ultracalc

R. R. Sheard

The BBC's own contribution to the quality spreadsheets now available for the computer which bears their name.

Look in any software list and you see a section headed "Financial Modelling". Most people see the heading and pass on to something more interesting, and who can blame them! Government after government has used massive financial models and look where it has got us; how can a mere micro compete with such skills? Well the term Financial Modeller hides in many cases the classic program — the Spreadsheet. In my November/December **A&B** Review of Computer Concepts' Beecalc. I explained some of the many non-accounting uses of Spreadsheets. However as we get new readers and new BBC & Electron users all the time I shall at least explain in outline the ins and outs of Spreadsheets.

AN INTRODUCTION

In simple terms, and in concept there is nothing very complicated about Spreadsheets, you are presented with an electronic piece of paper neatly laid out in columns and rows. The first row is numbered 1, the second 2 and so on. Similarly the first column is A, the second B and so on. Each box on the paper can then be easily identified; the top left is A1, the next on the right is B1 etc. Into any of these boxes you can put a number, words or a formula. This formula can refer to any other box by its co-ordinate. You can then build up anything from a family budget to a canvassing return in an election campaign. If for example in one box there is a formula summing up a whole column and an item is changed in that column the result is immediately recalculated. Obviously the screen cannot show the whole of the sheet at once but the cursor control keys quickly survey it down or across. Certainly it is relatively easy to write programs to do one or more of these types of application but how easy are they to modify and how flexible are the printing facilities?

So on to Ultracalc. I shall first give a general overview of the program. Then we shall look at more detailed aspects which enable you to handle more sophisticated applications. Finally I shall try and compare it with some other spreadsheets on the market now.

Ultracalc comes with the usual first class BBC Soft packaging containing a ROM and a professionally presented 80 page A5 manual in a spiral binding. To be quite frank looking at the outside, and knowing the sometimes less than enthusiastic reviews software from the BBC has had, I had that sinking feeling that all might not be well. But not for long!

First there is the old old problem of fitting the ROM, though the BBC do recommend that your dealer does it. This one is just like the rest. Easy to fit if you are confident with electronic bits but very stressful if you are like me.

Switch on and type * CALC and you are away and into a menuless Mode 7 environment — sorry about the jargon; what I really mean is that Ultracalc is not operated by selecting items from a menu and that it uses the memory efficient Teletext mode. Incidentally a nice little touch compared with some other ROMs is that when you type * HELP you get:

ULTRACALC: A spread-sheet program.
Type * CALC to enter, / * BASIC to exit.

For those with colour displays the structure of the sheet i.e. the column and row headings and lines of information, are in green; the sheet contents are in white. The display is also completely acceptable in black and white as well.

The display has as its first three lines operating information. Line 1 is in three parts e.g. A7, Label, INPUT OR COMMAND. That is, the co-ordinates of the box being worked on, the format of the information in it i.e. Lable (words), Value (number or formula) or Blank, and finally it tells you what Ultracalc is doing. For example INPUT OR COMMAND means that the sheet is waiting for you to tell it what to do; WRITING appears when you are saving a sheet and so on.

Line 2 shows on entering Ultracalc a copyright acknowledgement to Topexpress Ltd. On this my first encounter with the firm I can only say — watch this space. In normal running the line shows what is currently in the box noted in line 1. You might well say "why show the contents when you can see it on the screen?" The reason is that line 2 shows the underlying contents such as a formula and the screen shows the result which could be a number.

Line 3 is similar to line 2 except that it shows what you are entering into the box.

GENERAL CHARACTERISTICS

So that is what you see. Now let's look at the general characteristics of the sheet. Firstly its size; it is similar to the original spreadsheet Visicalc with 255 rows and 63 columns i.e. A1 to BK255. When you first enter Ultracalc 80 boxes are displayed A1 to D20.

The basic arithmetical functions available for formulae are + − * / and ∧ (i.e. raising a number to a power) with nine significant figures. Together with the more esoteric functions which I shall describe later and the fact that an unstated number of nested brackets are supported, this means that the most complicated formulae can be handled in one box. In contrast to many spreadsheets this is supplemented by the claimed ability to have formulae of up to 127 characters. Requirements for labels are less but upper and lower case are supported (I mention this because all the print-outs in the manual are misleadingly in upper case) and the maximum width which can be displayed, or printed, in respect of any single box is 38 characters.

We now move into the more complicated area of Ultracalc. Before I do so however I must warn you that it sounds very complicated because the power of Ultracalc is immense. But the beauty of this and indeed other spreadsheets is that you do not have to use every feature from the beginning to get value from it. This is true of many programs, even relatively simple word processors.

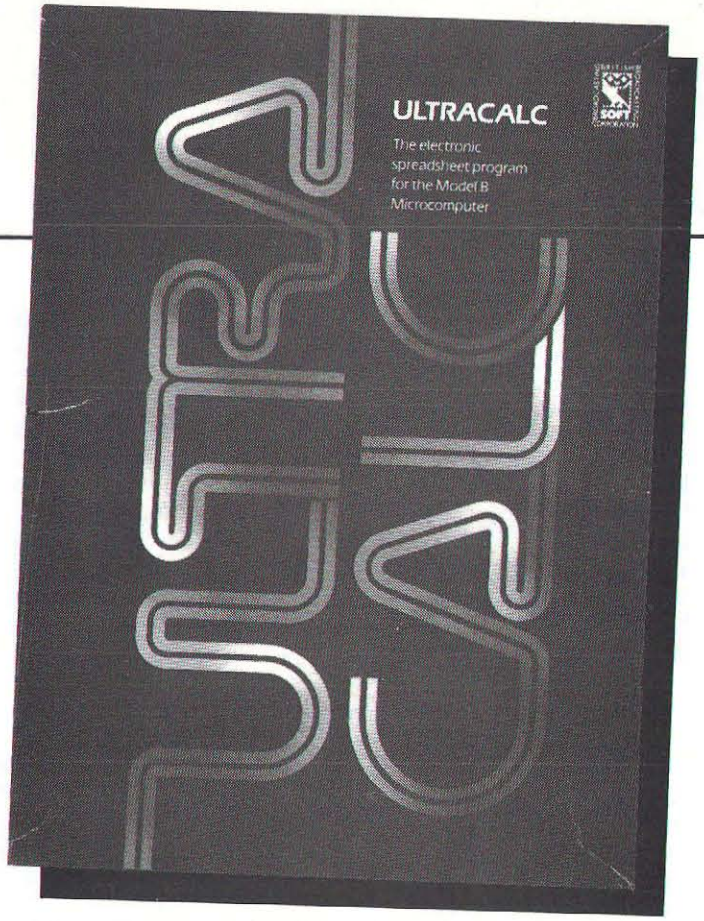
There are three parts to Ultracalc. The Command Mode, entering material on the sheet and the multitude of functions and facilities available.

COMMANDING

The Command Mode is the area of operation where you are setting the sheet up rather than just writing into one box. The program knows that it is in the Command Mode by the prefix / which precedes any command; a Return ends commands.

/ * is the usual way into the Operating System. It does seem to do everything that is required but be careful to save your work before moving between ROMs; I lost this article when going from Wordwise to Ultracalc to check a point!

All the other commands relate to the sheet and often use the concept of working over an area — in this article referred to as (area). In other words the command can have a suffix defining the top left and bottom right corners of the rectangle to



be affected — read on before saying you do not get that. Just to complicate it a bit more, the 'area' can of course just be a row or column.

GENERAL COMMANDS

/= or /G followed by a co-ordinate means go to that co-ordinate — by far the fastest way of moving a large distance on the sheet.

/A followed by RETURN and an arrow key converts TAB to a return key which also moves the cursor in the defined direction — very handy for filling in tables.

/B converts a box to a blank entry and say /BACIE5 would blank out the 15 boxes in the rectangle with the four corners C1 E1 C5 and E5.

/DC or /DR deletes a column or row respectively. /IC and /IR are the corresponding commands for creating new rows. This set of commands enables mistakes to be corrected without having to start again.

/H either prevents the box from being altered or releases it from its protection. This is useful for example in schools to protect base data — until they get hold of the manual! /HA(area) sets all the boxes in the area to the same protection as the current box.

FORMATTING

/F formats the box, i.e. it gets the layout as you want it. So /Fn gives any numbers in the cell n decimal places and /FL or /FR lines the entry up on the right or left of the box. In contrast to some other spreadsheets these can be 'stacked' (i.e. a box can have a L format with a defined number of decimal places. When you have got the format right you can use the command /FA(area) to repeat the format in a group of boxes. /WN (or WA(area)) sets the width of the display at up to 38 characters. Each column can be a different width; this is only for the display and does not affect the underlying box contents and attendant accuracy.

One neat touch is that the width can be set to zero, in other words a column can be hidden for display or printing; this is useful for intermediate calculations. To get the maximum 38 characters or to print without the column and row headings /Z is used which clears them off the display. Another useful feature is /– which switches between showing negative numbers with a minus sign or in brackets; in other words it helps to make accounts appear professional.

On top of that there is an arguably unnecessary touch, /~ makes all negative numbers appear in red. Mention of colour reminds me that Ultracalc provides for proud owners of colour monitors and for lecturers wanting to smarten up their displays. The function keys 0 to 7 provide coloured text and background.

/T is used to set Titles; i.e. it will hold a row and column on the screen wherever you are working on it. For example, if the top row is months they can be displayed even if you are down at row 255.

COPYING

In preparing a worksheet there is often a need to repeat words or a formula in several places. In the case of a formula the need is often to vary it according to where it is, for example if box A10 adds up boxes A1 to A9 and you want to do the same thing in column B, you need to have a formula in B10 which is identical in structure to A10 but different in actual references. Ultracalc does this extremely well exceeding in power for example the equivalent command in the first lady of spreadsheets, Visicalc.

PRINTING

/P(area) prints the defined area as shown on the screen; as noted above it will print the top and side grid unless it is first remove with /Z. If you want a record of the formulae used /O(area) gives the required printout.

SAVING

/S(area) saves a named filed /V(area) verifies that it has been saved properly and /L loads it back again. As with for example, Wordwise the cassette load is, in my view poor as you are not given a chance to rewind the tape if a section is not read first time. However after a bad load you have got back everything up to the point that the read error occurred. One good feature of the loading is that you can load into a given area without destroying work already on the sheet elsewhere.

So we have looked at the various commands. Now let us look at putting material onto the sheet and the additional features provided to help.

ULTRA EASE OF USE

First there is moving around; the cursor keys work as normal with shifted arrow moving 4 columns or 10 rows at a time. If you make a mistake while entering text or a formula the Delete key is used, the cursor being moved during editing by Function Key 8 (left) and Function Key 9 (right).

Similarly to alter an old entry without retyping you go to the box concerned and use Shift Copy which copies the entry to the input line where it may be edited. One problem with many spreadsheets is that if you start an entry and if it then cannot work out what it means it prints ERROR; similarly start with a letter and it will only accept it as text not a formula. Other spreadsheets then enable you to 'force' a value by starring with + or text by starting with ". Not so with Ultracalc; in this case the program assumes that it is a formula unless it cannot make sense of it, in which case it takes it as text; the ability to force text is still available but rarely used. Simple, some would say obvious, but it is the first time I have seen this neat touch.

Finally there is the usual facility to switch recalculation to manual by /M ; each time return is pressed the whole sheet is recalculated, this takes little time on a small sheet but as the sheet gets larger the time taken for each complete recalculation becomes annoying particularly when first building up the sheet as you have to wait between entries; with manual recalculation switched on recalculation only takes place with Control A. Another neat little touch is the Command Cell;

CONTINUED OVER

Ultracalc

This can contain a regularly used command such as go to a particular box or print a certain part of the sheet — this can be executed with Shift-Copy Return.

YET MORE

Having read so far you may have begun to realise the enormous programming complexity of Ultracalc and be crying "No more, let me rest!" Sorry, but there is more and it is the functions which follow which can give the BBC Micro the numerical and general handling power parallel to the text handling of good word processors. You may feel that some of the functions and facilities which follow are unnecessary, indeed some are for many people, but they are there when needed. Certainly secondary school mathematics and science departmens will appreciate the range, i.e. trigonometric functions; RAD(x) & DEG(x) — degrees to radians and vice versa; ASN(x) ATN(x) & ACS(x) — arc-sine, arc-tan & arc-cosine; numerical functions ABS(x) — gives the positive value of x e.g. ABS(−56) = ABS(56) = 56; EXP(x) — e raised to the power of x; FIX(x) — gives the integer part of a number e.g. FIX(12.99) = 12. If you are doing accounts this is essential for if you are for example doing VAT calculations by multiplying by 1.15 you will find that the 9 figure accuracy causes columns to apparently not add up properly by the odd penny or two — giving accountants heart attacks. So you use the formula FIX((x * 100) + 0.5)/100 where x is in £ — this rounds up to the nearest penny.

Then there is LOG(x) log to base e; PI gives value of pi; SGN(x) gives +1 if x is positive, −1 if negative and 0 if zero; SQR(x) square root; TOP gives number of bytes remaining: it's useful to have this in a box on the screen if you have a large sheet as a reminder. If however you do run out the system does not crash as some do but simply displays M in the top right hand corner and prevents further entries until you clear some space.

FACILITIES

SUM(area) adds up all numbers in the defined area. CNT(area) counts up all the numerical values in the defined area. This can for example be used with SUM to find the average. MAX(area) & MIN(area) find the maximum or minimum values in the defined area. NPV(interest rate, area) gives the net present value of a series of values at the given interest rate; in contrast to some other spreadsheets this uses the first entry as a Period 0 payment. This function forms the basis of many interest rate calculations. IF(logical expression, value 1, value 2) may find few uses in the ordinary home but there is no extra charge!

It first looks at the 'logical expression' which is made up of so called logical operators such as <, >, =, AND, OR etc., and decides whether it is true and prints value 1 if true and value 2 if false (values can also be words). For example box A1 could be your Bank Balance, box B1 your debts, box C1 the words 'Great, you're solvent' and box D1 the words 'Bankrupcy and shame'. Then IF(A1 B1 OR A1 = B1,C1,D1) gives suitable messages!

LKP(expression, area 1, area 2) is another frightener! This looks for the 'expression' in area 1 and if it finds it displays the entry from the corresponding box in area 2. The 'expressions' can be a number or a word and in this latter case wild cards * and ? can be used in the match; e.g. J * would match any word or words beginning with J whereas J? would match any two letter word starting with J. If for example you have a list of names or perhaps references to a technical paper and want to change their order prior to printing, this will do it. Only space precludes me from a detailed explanation, but it works quickly.

You may by now be thoroughly exhausted but may I remind you once again that you can make good use of Ultracalc without using or even knowing how to use most of the functions but they are there as you develop uses for the spreadsheet.

I have already mentioned the 80 page manual. It seems to me a very good compact, teach yourself book with about 16 pages of well chosen examples illustrating as many aspects of Ultracalc as possible. I suspect however that it will be found hard going by the less mathematically inclined, but the effort is really worthwhile.

NEGATIVE VALUES

So far I have had nothing but praise, however even the reviewer of a new Rolls Royce has to admit that there are some faults. So what about Ultracalc? Firstly, a relatively serious difficulty, no guidance is given for transferring part of a sheet to a word processor such as Wordwise or View to enable it to produce a table for inclusion in text or for the table to be edited perhaps with printer control codes. In the same vein no details are given about Ultracalc file structures to help more advanced users.

A most irritating faults is that on the screen and on print-outs there is a blank single character column between each column which prevents neat underlining across a number of columns. There is also a somewhat slow reaction to the keyboard, it being easy to type faster than the program can accept data with a consequent need to watch the display. I must add that the basic screen display is rather unimaginative in its minimal use of colour, the use of function keys is poor and there are no facilities to use an 80 column mode.

But all these comments are carping criticism. So let's compare it with some other spreadsheets. First Beebcalc the other ROM based program from Computer Concepts. The latter only has two real advantages over Ultracalc, price and simplicity, and the simplicity comes from the much more limited features. Although to be fair to Beebcalc it makes much better use of BBC features such as the Function Keys and colour, can be linked to Wordwise and is therefore still a good buy if you only need a narrow range of features. In speed and use of memory the two seem equally good. The other comparison I shall make is with Visicalc the program which started it all bringing computer power to the non-computerate.

Historically it took about two to three years to produce the second good spreadsheet for CP/M machines, Supercalc. This implies to me at any rate that they are very difficult to write, however we now have three ROM based sheets for the BBC, Beebcalc, Ultracalc and Viewsheet certainly the first two seem to use some different principles from Visicalc. The best example being that on normal Visicalc you cannot actually write on box BK255 as it takes too much memory setting aside space for all the other boxes — not so with Ultracalc which does not appear to use memory like that. Overall Ultracalc performs fast and better than the Apple version of Visicalc with one slight reservation that Ultracalc can be crashed whereas Visicalc is immensely robust. I must emphasise however that Ultracalc is largely crash proof.

BOTTOM LINE

So as they say — what's the bottom line? Well if you have to buy a spreadsheet now and I emphasise now. Then compare Ultracalc with the new Viewsheet from Acornsoft and buy the one which suits you best. If you have already got Computer Concepts Beebcalc as I have and can accept its limitations for the time being I suggest waiting until they bring out the upgraded version which should be available at a good exchange price. If you can wait I do feel it might be worth it so that you can compare the three products side by side later in the year.

I cannot help ending with a word to the BBC. If all your future products are of this standard your software income will render the next increase in licence fee unnecessary.

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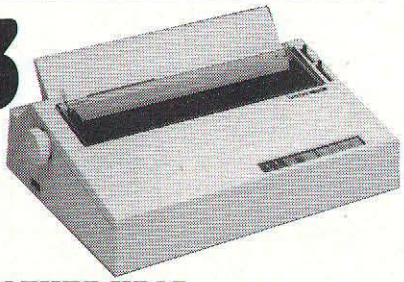

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Quirks in BBC BASIC

B.M. Landsberg

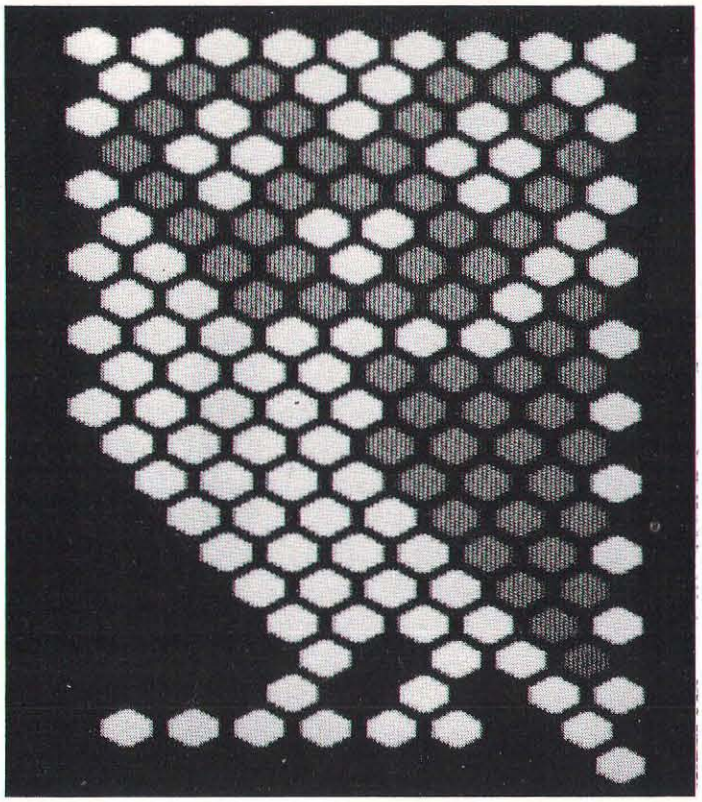
A few surprises and some instructive example to be found in the Beeb's very own BASIC.

The BBC micro has some very advanced BASIC features, but there are some unusual, and even unexpected, wrinkles to be found in its implementation. The aim of this article is to alert the BBC user to some potential programming problems and pitfalls, and to discuss some of the features of BBC BASIC that make it superior to many other BASICS.

INPUT AND READ

The first surprise comes when keying in data using the INPUT command. Consider Program 1 as a very simple example. You have disabled the (ESCAPE) key (using either the *FX14,6 or *FX229,1 command), and are running the program. There is no way of exiting the program short of pressing the (BREAK) key — right? Wrong! The INPUT routine treats what has been typed in as a string whether or not it is a string or an integer that is being read. This means that when it encounters an unpaired double quote character (ASCII value 34), it exists the program with the error message 'Missing " at line. . .'. To protect a program against this, there seems to be a little alternative other than either writing your own input routines using GET or INKEY, or using he ON ERROR GOTO statement.

It is instructive to examine what happens when various inputs are used, and to follow through the responses of Programs 1 or 2. Typing HELLO or "HELLO" will enter the string HELLO into the input, but if "HELLO"HELLO is typed, the interpreter seems satisfied once it finds a matched pair of quotes and only recognises the first HELLO. To enter a double quote character in BBC BASIC in a program. It is necessary to have two double quote characters together — for example PRINT """" prints one double quote character. This manifests itself when inputting "HELLO""HELLO" and the middle pair of quotes are interpreted as a single quote character, producing HELLO"HELLO as the string. However, if the string is not enclosed with double quote characters, this interpretation of a double quote character is not made, so if HELLO""HELLO is typed in, it is entered directly without change.



Next, we try to input a string which has a comma in it, but typing in ABC, DEF only enters the string ABC into X$. If line 20 of the program had read INPUT X$, Y$ instead, then X$ would have contained ABC and Y$ would have contained DEF. Evidently the comma is interpreted as a separator of multiple inputs. In order to enter a string containing commas via an INPUT statement, it should be enclosed with double quotes — for example "ABC,DEF" will enter the string ABC,DEF into X$.

Finally — and of greatest importance — typing in a single quote character or a string like "HELLO causes the program to exit with a 'Missing " at line. . .' error You may find it amusing to type a single quote character into some of the software you may have bought!

If INPUT is used to read an integer, evaluation stops once it reaches a character it cannot understand in a numerical context — thus 234, "234", 234FFF, "234FFF" all return a value of 234, while an unmatched quote once again causes the program to exit with a 'Missing " at line. . .' error.

You might have thought that INPUT interprets what is typed at the keyboard in exactly the same way that READ interprets what is in a DATA statement, but unfortunately this is by no means the case. The main differences seem to be in the way variable names and the ampersand (&) characters are treated. The following examples refer to numbers only, and different results will be found it strings are to be entered via READ. The first column in Table 1 shows what is entered either into an INPUT via the keyboard, or through a READ via a DATA statement. The second column shows how it is interpreted by an INPUT routine, and the third column shows how it is interpreted by a READ routine.

FOXED BY HEX

One important difference is that you cannot INPUT a number in hexadecimal format as it does not seem to know what to do with the ampersand character (&) and the number gets entered as zero, while READ will enter the correct number (&1000 *is* equal to 4096). INPUT allows the number to be enclosed in double quote characters, but any attempt to READ numbers enclosed in double quotes will cause the data to be interpreted as a string causing a 'Type mismatch error at line. . ' error to be reported.

Another important difference is that while INPUT does not understand alphabetic characters (if a number is being read), READ will try to interpret it as the value of a variable with that name. In the example in Table 1, INPUT X will assign a value of zero to X if ABC is typed in at the keyboard, while READ X will usually exit the program complaining about a 'No such variable at line. . .' error if ABC occurs in the DATA statement. However, if in the program ABC has already been assigned a value (e.g. ABC = 100), then READ X will assign that value to X if ABC occurs in a DATA statement. These findings are in direct contradiction to what is stated on

```
   10 PRINT
   20 INPUT X$
   30 PRINT X$
   40 GOTO 10
>
>RUN

?HELLO
HELLO

?"HELLO"
HELLO

?"HELLO"HELLO
HELLO

?"HELLO""HELLO"
HELLO"HELLO

?HELLO""HELLO
HELLO""HELLO

?ABC,DEF
ABC

?"ABC,DEF"
ABC,DEF

?"HELLO

Missing " at
line 20
```

LISTING 1

```
10 INPUT "A = " A "B = " B "C = " C
20 IF A=B THEN IF A=C THEN PRINT "A
=B AND A=C" ELSE PRINT "A=B AND A<>C"
ELSE PRINT "A<>B"
30 PRINT : GOTO 10
>RUN
A = 2
B = 2
C = 2
A=B AND A=C

A = 2
B = 2
C = 3
A=B AND A<>C

A = 2
B = 3
C = 2
A=B AND A<>C
```

LISTING 2

```
10 X = 0
20 X = X + 1
30 PRINT X
40 GOSUB 20
```

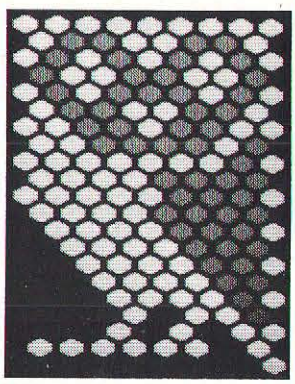
LISTING 3

```
 10 X = 0
 20 PROCrecurse
 30 END
100 DEFPROCrecurse
110 X = X + 1
120 PRINT X
130 PROCrecurse
140 ENDPROC
```

LISTING 4

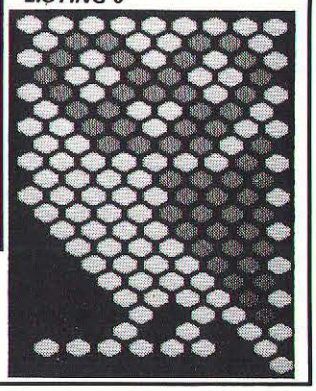
```
 10 X% = 0
 20 PROCrecurse(X%)
 30 END
100 DEFPROCrecurse(X%)
110 X% = X% + 1
120 PRINT X%
130 PROCrecurse(X%)
140 ENDPROC
```

LISTING 5



```
 10 X = 0
 20 Y = FNrecurse
 30 END
100 DEFFNrecurse
110 X = X + 1
120 PRINT X
130 =FNrecurse
```

LISTING 6



pages 227-228 of the BBC User Guide. which specifically states that variable names cannot be used for numeric data!

Note that &ABC is a perfectly good hexadecimal number in its own right (just like &1000), and READ has interpreted it correctly in Table 1. Finally, unpaired double quotes cause a 'Missing " at line. . .' error in both cases.

LOGIC

Those of you who are used to PASCAL or Microsoft BASIC will be surprised at the way the IF... THEN...ELSE construct has been implemented on the BBC micro. Program 2 shows an example of a program which uses an IF...THEN IF...THEN.. ELSE...ELSE construction. When it is run, it is evident that the response when typing in A and B as different numbers produces an unexpectedly wrong answer! It should be noted that the same code works perfectly in Microsoft Basic. What then is wrong?

It is evident that when the BBC BASIC interpreter has to look for an ELSE, it always accepts the first one it meets no matter how many IF statements came before it. In our example, it doesn't seem to matter whether it is the first condition (A = B) or the second condition (A<>B BUT A = C) that is not met, it will always perform what is after the first ELSE and print "A = B and A<>C". There is no way of making it ever performs what is after the second ELSE in this example. The problem only occurs when every ELSE is not matched uniquely to an IF statement, and so the construct IF..THEN..ELSE IF.THEN..ELSE etc. will always perform as expected.

Note that all the IFs and ELSEs are on one line in Program 2. This is actually quite necessary to make it work even as it does. Try rewriting the program with each IF and ELSE on a separate line to see how even more chaotic the results may be.

Another possible source of

CONTINUED OVER

TABLE 1

Comparison of how INPUT and READ interpret data

X	INPUT X	READ X DATA . . .
1000	1000	1000
"1000"	1000	Type mismatch at line . . .
(1000)	0	1000
&1000	0	4096
ABC	0	* No such variable at line. . .
&ABC	0	2748
1 * 1000	1	1000
?&E00	0	!13
"	Missing " at line. . .	Missing " at line . . .

* If ABC has already been given a value, then that value will be taken instead of giving an error message. Note that pseudo-variables like PAGE, TOP, TIME etc. will always return a 'No such variable at line . . .' error if in a DATA statement.

! This corresponds to the first byte of a BASIC program, but you may get a different result if PAGE is not set to E00.

confusion is that the construct IF COND1 OR COND2 THEN... or even REPEAT...UNTIL COND1 OR COND2 evaluates both conditions even if the first one is true. This happens whether the conditions are functions, comparisons or variables, and may cause confusion if evaluation of either condition alters any variables, or one condition is intended to stop the other from being evaluated. One situation in which I have come to grief is the following:

```
DIM X(3)
I=0
REPEAT.....:I=I+1:UNTIL
I=4 OR X(I)=0
```

This program fragment was intended to continue until it had worked on all elements of the array (in which case the value of I would be 4 or until it finds that X(I) has not been assigned a non-zero value.

What actually happens is that the program terminates with an "Array" error if X is filled with non-zero values, because even if I=4 it still asks whether X(I)=0, thus causing access to array element X(4) in an array that is declared only up to 3.

This also applies to the case of IF COND1 AND COND2 THEN ..., as even if COND1 is false, it still evaluates COND2.

PROCEDURES, FUNCTIONS AND RECURSION

It should be said that probably the most important difference between BBC BASIC and most other BASICs is the possibility of using procedures and functions, and now we examine quirks and limitations in their implementation. The first finding is almost the absence of a limitation — there appears to be no limit to the number of procedures and functions you can have in any program provided there is sufficient memory for them. I have tested this by defining over 255 procedures in one program and on problems of any kind were encountered. The next test I performed also gave good news, and that is the depth to which a procedure may call another procedure (or even itself). Before discussing the results, it is instructive to compare the effect of procedure or function calls with the best that most BASIC implementations give you — the GOSUB call.

Program 3 is doomed to failure, but is designed to show how many times one subroutine may call another before an error message of some kind is produced. When run, it stops on the 27th iteration with the message 'Too many GOSUBs at line 120'. This feature is well documented in the User Guide. Thus care must be taken not to 'blow the stack' when subroutines call other subroutines — the depth of call that can be reached is less than 30 no matter how much memory is available. Other BASICs seem to have a similar limitation.

STRUCTURAL

The situation is quite different with procedures and functions. Program 4, when run on a BBC model B micro using MODE 7, showed a depth of call not of 27 — but a phenomenal 2158! In a graphics mode which reserves 10K of memory (e.g. MODE 4), the depth of call was 1449, and in a 20K graphics mode (e.g. MODE 1) it was 661. What does all this mean?

It should be mentioned that this program is recursive — which simply means that a procedure makes a call to itself, or calls other routines which call it. A lot of problems may be solved efficiently using recursive techniques and BBC BASIC is designed to allow such recursion.

In order to understand what is going on, we ask what happens when a routine (which means a procedure or function) A calls routine B which in turn calls routine C. Then C is called, it must 'remember' where in routine B to return to when C has finished (and also any local variables in B). and in addition where in A to return to when B has finished. This process occurs whether A, B and C represent the same routine (in which case the call is recursive), or different routines. and the depth to which we may make such calls is limited by the memory of the machine. Some languages — for example LOGO — can deal with Program 4 in a different way allowing such a procedure to call itself for ever. For a more detailed explanation of everything in this paragraph, the reader is advised to refer to my article "Some Experiments with Recursion" which appears in *Computing Today* (April 1984).

PROVEN

Now we can explain our observations! BBC BASIC reserves the area of memory between HIMEM and LOMEM as free memory, and by dividing (HIMEM — LOMEM) by the number of iterations that Program 4 made, we can show that each procedure call uses up 13 bytes of memory. This formula is reliable only if the program does not reserve much memory for variables such as large arrays or strings. Whichever graphics mode we are in, we always end up with the same answer.

As well as just calling procedures, one may pass integers, real numbers and even strings as arguments. These are treated as local variables, and will increase the number of bytes used per call. Program 5 is very similar to Program 4 except it passes the integer variable X% through as an argument, and using the method described above, it can be shown that each level of procedure call uses up 21 bytes. If every occurence of X% in Program 5 were replaced by X, each procedure call now would use up 22 bytes. This is not too surprising as X% represents a 4-byte INTEGER variable and X represents a 5-byte REAL variable, and this demonstrates that the memory usage in passing each parameter consists of an overhead of four bytes plus the number of bytes that the parameter itself needs. Strings may also be passed into procedures, and passing a string of length 10 (which takes 11 bytes of memory) makes each procedure call use 28 bytes. Passing more than one argument through a procedure call raises the number of bytes it uses in a predictable fashion.

Procedures may also contain LOCAL variables, and if in Program 4 a new line (say 105) containing LOCAL A% were added after the DEFPROC statement, each procedure call uses 21 bytes just as if an integer variable had been passed through as an argument. Similarly, if our new line had contained LOCAL A, each call would use up 22 bytes.

If you wish to write recursive programs (or just split your program into lots of little procedures) we now have a formula which we may use to calculate the number of bytes each procedure uses up per call, and that is:

13	for the procedure call
+ 8	for every integer
+ 9	for every real number
+ (5 + N)	for each string of length N (whether LOCAL or passed as a parameter).

Now we come to functions, and Program 6 demonstrates how a recursive function call might be made. Using the methods outlined above, we can show that each simple function call consumes a massive 25 bytes! The overheads caused by passing parameters or by declaring LOCAL variables apply equally to functions as well as to procedures, and replacing the 13 by a 25 in the above formula describes the memory usage of each function call.

The conclusion I draw from all this is that procedures and functions are very valuable computing tools, but care must be taken in their use if you write any programs which are recursive to any great depth.

We now leave the subject of recursion, but have not yet finished with procedures. It appears that a procedure may have many entry points, and will continue executing until it meets an ENDPROC. Program 7 shows an example of this, and the results when run show that when PROCfirst is called, it also executes PROCsecond and PROCthird, and keeps going until it

```
   10 X = 0                      1200 DEFPROCthird(X)
   20 PROCfirst(X)               1210 X = X + 1
   30 X = 10                     1220 PRINT X
   40 PROCsecond(X)              1230 ENDPROC
   50 X = 100                   >
   60 PROCthird(X)              >
   70 END                       >RUN
 1000 DEFPROCfirst(X)                 1
 1010 X = X + 1                       2
 1020 PRINT X                         3
 1100 DEFPROCsecond(X)               11
 1110 X = X + 1                      12
 1120 PRINT X                       101
```

LISTING 7

meets an ENDPROC statement. If lines 1030 and 1130 containing ENDPROC are added, the program outputs 1, 11 and 101 as expected. Program 7 not only demonstrates a possible short cut to coding overlapping procedures, but highlights the fact the BBC BASIC does not complain, and the sort of error that might occur, If an ENDPROC statement is accidently omitted.

VAL AND STR$

The functions VAL and STR$ are complementary in that the former converts a string to a numerical value, and the latter converts a numerical value to a string.

VAL seems to act upon a string a little bit like INPUT applied to a numerical variable, in that it evaluates the string only as far as the input makes numerical sense. For example VAL("234.5ABC") returns 234.5, while VAL("&1000") chokes upon the ampersand character and returns zero.

It is STR$ which contains the most surprises! STR$ handles variable names and hexadecimal numbers well enough, but what do you think STR$(234.5ABC) would do? If you guessed that it returns the string "234.5" you would be wrong! In fact, the program exits with a 'Missing)' error. It is relevant to note here that neither VAL or STR$ need their arguments to be in parentheses, and for example the rather strange looking STR$&10 will return "16" just like STR$(&10). Returning to our earlier example, if we now try PRINT STR$234.5ABC we get the following response:

```
234.5
No such variable
```

If we assign a value to the variable ABC, this value is printed out instead. For example, ABC = 100:PRINT STR$234.5ABC gives the following response:

```
234.5
      100
```

It is evident that when STR$ meets a character it cannot evaluate as part of a number, it interprets whatever follows as a BASIC entity. It also appears that STR$ can not be persuaded to return a string in hexadecimal format — for example PRINT STR$(B100) merely results in a 'No such variable' error.

STR$ also shows round-off errors in a systematic way, and we will consider numbers to three decimal places. Whereas STR$(63.001) will return a string containing 63.001, STR$(64.001) will in fact return a string containing 64.0009999. Upon closer investigation it appears that all such 2-digit numbers less than 64 are returned exactly, and all such 2-digit numbers greater than 64 show this kind of round-off error. Similarly, all such 3-digit numbers below 512 and 4-digit numbers below 4096 show no round-off errors. It is no coincidence that these boundaries are all powers of eight (for example 4096 is 8 to the power of 4), and these results tie in with the way real numbers are stored in BBC BASIC.

VDU – RELATED COMMANDS

The VDU command is normally followed by a series of numbers which may be separated by commas, spaces, or semi-colons. These numbers represent a series of bytes (or if semi-colons are used, the number will be sent as a series of two bytes), and the command VDU X,Y produces the same result as PRINT CHR$(X);CHR$(Y). Note that VDU X; is interpreted as PRINT CHR$(X MOD 256);CHR$(X DIV 256) — note the order in which the bytes come! If some of the characters in a VDU sequence are control codes (ASCII values 0-32), it may initiate an action like moving cursors, defining characters and windows, clearing the screen etc. Many BASIC commands (for example PLOT, GCOL, COLOUR) may be expressed by a VDU command.

After that all too brief survey of what VDU commands are supposed to do, let us see what happens if we send numbers which are negative or too large. As a character must have an ASCII value between 0 and 255, 'too large' refers to numbers greater than 255. VUD 100 prints the letter "d" (as expected because CHR$(100) is a lower case D), but so do VDU 356 and VDU −156. Evidently, a positive number X is treated as X MOD 256, but a negative number X is treated as (256-X) MOD 256. CHR$ acts in a similar fashion too. It is noteworthy that VDU 25699 will print a "c", while VDU 25699; will print "cd" — if you are not certain why then read these last two paragraphs again.

The commands MOVE and DRAW (which may be invoked from a VDU 19 command) need two byte variables which are interpreted as signed numbers and thus must be between −32768 and 32767. Any number outside this range gets "wrapped around" — for example MOVE 65536, 65536 is identical to MOVE 0,0, and the sequence of commands MOVE 32767,32768:DRAW 32768,32768 pauses for a short time before plotting a diagonal line across your screen (because 32768 is actually interpreted as −32768). If you are writing graphics software and allow points to be plotted anywhere on the assumption that any point outside the window will not appear on the screen, beware of letting your numbers get much over 60000!

TAB is used to place the cursor at a particular point on the screen, and is related to the VDU 31 call. If you wish to use PRINTTAB(X,Y)" * " to print a star at a required position on the screen, and either X or Y are larger than the text window allows, the TAB command will be completely ignored. Thus PRINTTAB(10,10) " * " prints a star on the tenth column of the tenth row, but remembering we may only have rows 0-31 of text, PRINTTAB (10,32)" * " does not even make a valiant effort to put the star in column 10 of the next row. Many VDU commands are similar in this respect. Another common feature is the wrap-around which occurs for numbers outside the range 0-255, thus for example PRINTTAB(256, −246) is treated as PRINTTAB(10,10).

HELP NEEDED

The final peccadillo to be discussed in this article concerns VDU 5 which causes text to be written at the graphics cursor rather than at the text cursor. In a program I was writing text was being displayed in inverse mode, but then I wanted to display text still in inverse mode, but at the graphics cursor so that I might write 'between the lines'. In text mode, it seems easy to get inverse mode by first setting the text foreground colour to black (COLOUR 0) and then setting the text background colour to white (COLOUR 135). Note that COLOUR 135 works in all graphics modes 0-6! However, I could not find any combination of COLOUR or GCOL commands which would make the text background come out as white once VDU 5 had been called. I still have not found a good way to do it — in fact I would be very grateful to hear from any of you how to overcome this problem!

I hope this article helps you to get to grips with BBC BASIC.

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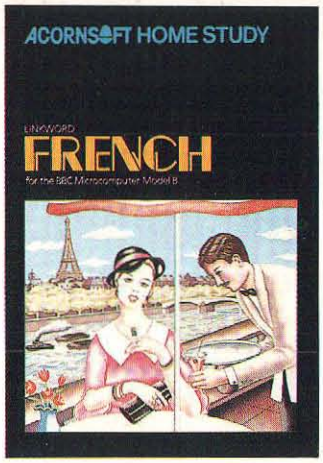

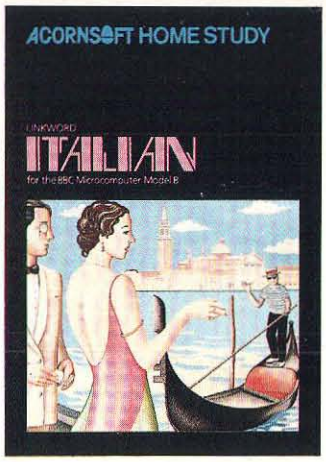

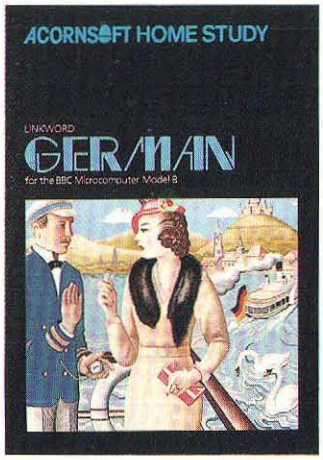

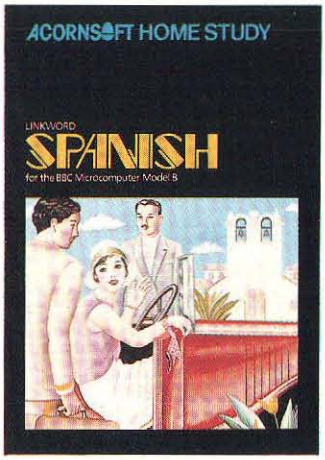

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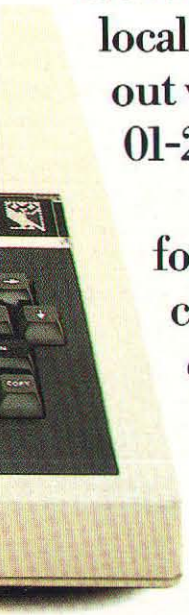

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ACORNSOFT

E-Print

Valerie P Loose

Easy access to your Epson printer with this utility which handles text files. Direct control of Epson commands at your fingertips.

This program is called EPRINT and was written specifically to simplify the use of the Epson FX80 printer, particularly the fancy font styles.

The program will also work to a limited extent with the MX80 series printers. The documentation is in two parts, one is the EPRINTed version and the other the raw text (printed using the VIEW print facility so any spurious unintentional blank lines are caused by VIEW perforation skipping).

I have used byte arrays as the largest number to be stored is 225. The DATA statements on lines 440 to 480 refer to commands, the data is in groups of five numbers as follows:

1st number array element address

2nd number the number of numbers/characters in the relevant Epson code or an indicator of special action

3rd number the first ASCII character in the EPSON code

4th number the alternative to the first ASCII character (the first character switches code on the second turns it off e.g. the entry corresponding to $e (33,8,77, 80,0) has M as the first character and P as the second)

5th number a switch indicating which of the 3rd or 4th numbers should be in the Epson code e.g. $e starts off with this number 0, the first time $e is used this is set to 1 and ESC M is sent to the printer, the next time $e occurs this number is reset to 0 and ESC P is sent.

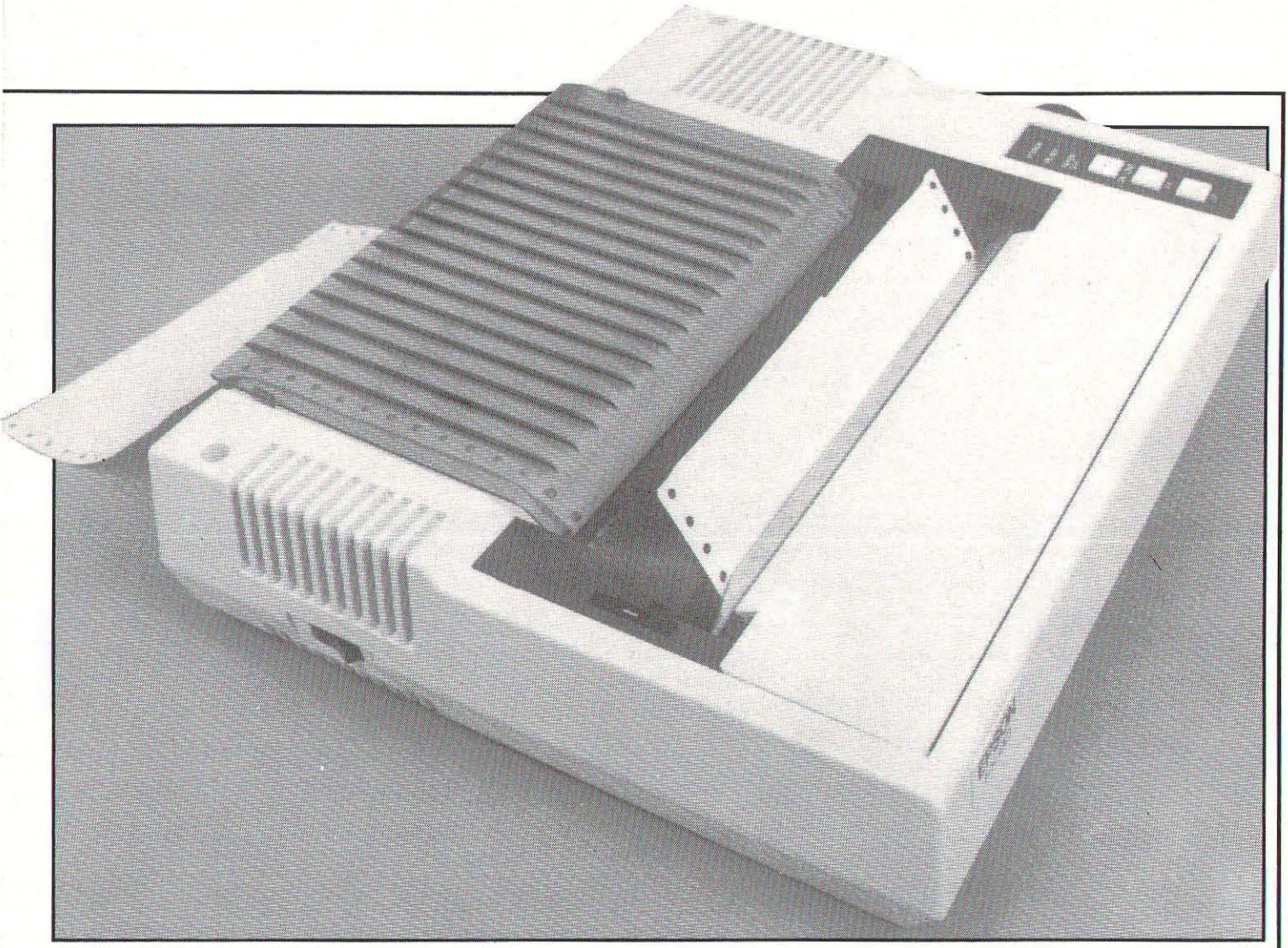
The character following the $ is read, converted to upper case if in lower case, the 'smallest' character allowed is $ (36) so 36 is then deducted from the code. The first 5 numbers of line 440 are 0,0,36,0,0 — this is for the $$ command which prints a $, the second number is 0 as no EPSON code is needed to print this, the third number is 36 ($) and the fourth and fifth numbers are not needed so are set to zero. For Epson codes of the form (CHR$ (n) the second number is 1, it is 2 for the CHR$(27); "c" codes (ESC T is the only one of these the rest needing special action). A second number of 3 indicates codes CHR$(27);"c"; CHR$(n) etc. Second numbers =6 require special action — usually involving the reading of the current switch value eg $e, 0 means switch on and one means switch off. The most difficult one to implement was the super/subscript facility.

The set of DATA statements on lines 490 to 520 refer to DDT commands, here four numbers per entry are required. DOT commands can only contain alpha characters, the smallest of which is AA which is coded as 65* 10+65=715 which is reduced to 0 on line 780. There is however no command. AA the smallest being. DC (68*10+67−715). The second number is again the number of characters in the Epson code, or 9 which indicates special action needed. The third number is the character following ESC and the fourth is the maximum value any number following the dot command can take, zero indicates that the value of the number is not critical or that no number is allowed.

Both blocks of DATA statements are terminated with -1'so it would be very easy to add more data items without the need to reorganise the existing ones.

The data is read into parallel arrays, A% to D% being used for $ commands and E% to G% for DOT commands. Variables and procedures are as follows:

P%	Keeps track of the input data line numbers to facilitate error tracing
U%	A switch for the underline command 0 meaning off and 1 on
cr%	Set to 1 if the last character read was a RETURN
st%	Indicates if the last RETURN read should be printed (if the next DOT command read is .FF, printing a carriage return at the end of the line before the new page could skip to a new page anyway so the effect would be a blank page, also if .SP (ESC J) is used then the space left would also be greater than expected if the line before the gap was terminated with a RETURN)
sup%)	Are flags indicating the state of the super/subscript commands
text$	Used for error messages
eof%	End of file indicator
ln%	The second parameter of PROCerror
K%	For reading data characters, if a command is read then points to the array element corresponding to command and for $ commands is then set to the character following the $ command which would otherwise be lost
size%	The character to be printed after ESC in the print code (see 3rd number decription above) — $ commands only
char2%	The alternative to char1% — $ commands only
char%	Similar to char1% but used for DOT commands
maxn%	The 4th number in the DOT commands array data (see above)
T%	The last character read on DOT command lines
N%	Used by PROCdollar for super/subscripts and PROCdot for the number (if any) which follows the dot command
PROCdollar	executes $ commands
PROCdot	executesDOT commands
PROCuline	executes code to switch underlining on/off
PROCchkflag	checks state of and sets sup% and sub%, sets N%, K%
PROCsc	prints single characters
PROCsw2	executes DOT commands of +/− form (ESC char codes)
PROCsw3	ditto but (ESC char 1 or ESC char 0 codes)
PROCspecial	selects non standard routines
PROCdc	sets up a user defined character
PROCcr	resets the redefined character to its standard font
PROCperf	sets/cancels perforation skipping
PROCht	sets horizontal tab positions
PROCvt	sets vertical tab positions
PROCerror	prints error messages (all errors are hard)
FNcalccom	calculates value of DOT commands
FNreadn	reads number on DOT command lines



I have had it suggested that the program should provide commands to centre text and automatically print page numbers but decided not to implement them as besides greatly increasing the code this would take the program along the path towards a word processor which was certainly not my intention. To centre text one has to know what font style is currently being printed and page numbering requires keeping track of the 1/216" line increments, current line spacing etc. Both facilities are not difficult to achieve manually and I have certainly had no problems myself — see the documentation for examples.

Not every command in the Epson manual has been implemented, in particular bit image mode. I used ESC W instead of SO for enlarged characters because SO is cancelled by line feed and all the other font changing codes have to cancelled by specific input of a code. Reverse feed (ESC J) was not provided because of possible damage to the printer if used when the print head is close to the paper perforations. Vertical tab positions /ESC B) are easily set by ESC b Ø (.VT Ø etc.).

USING THE PROGRAM

A program for printing text files on an Epson FX80 printer.

This documentation should be read in conjunction with the FX80 Operation Manual.

The text file consists of the characters to be printed and commands to control the layout, font style etc. The characters in the file must have been written using BPUT (VIEW writes its files in this form).

There are three types of command:

1. Dot commands — these must be on separate lines and the first character on the line must be a full stop. The full stop is followed by two alpha characters (case immaterial) and there should be no space between the full stop and the letters. Some commands are followed by + or − (again no spaces between the letters and the + / −) and others by one or more numbers — spaces are allowed between letters and numbers. Dot commands are terminated by return — ASCII code 13.
2. $ commands — these may appear anywhere in the text (except in dot commands); the $ is followed by a single character which may be a letter (either case), another $, a full stop, or an underline.
3. Underline — the first occurrence switches on underlining and the next switches it off.

The printer is initialized (ESC @) before and after printing the text. The commands are described below in the approximate order given in Appendix H of the Epson FX80 Operation Manual.

CONTINUED OVER

COMMANDS

Print Mode

Epson	Eprint	Action
SI) DC2)	$c	sets/cancels condensed mode. Input text: $ccondensed$c and normal prints as: condensed and normal
ESC 4) ESC 5)	$i	sets/cancels italics. Input text: $iitalics$i and normal prints as: *italics* and normal

Epson	Eprint	Action
ESC !	.PM n	Sets print mode. 0 <= n <= 63. The program stops with an error message if n > 63.
ESC -	_	Sets/cancels underline mode. Input text: an _underlined_ word prints as: an <u>underlined</u> word
ESC E) ESC F)	$z	Sets/cancels emphasized mode.
ESC G) ESC H)	$d	Sets/cancels double strike mode.
ESC M) ESC P)	$e	Sets/cancels elite mode.
ESC S 0) ESC S 1) ESC T)	$+ $-	$+ sets superscript mode or cancels subscript mode. $- sets subscript mode or cancels superscript mode. Input text: Ax$+2$-+Bx-1++C prints as: Ax^2+Bx_1+C
ESC W	$h	Sets/cancels enlarged mode.
ESC p	.PR+ or .PR-	+ sets proportional mode - cancels it.

Line Spacing

Epson	Eprint	Action
ESC 0	.LS0	1/8" line spacing.
ESC 1	.LS1	7/72" line spacing.
ESC 2	.LS2	1/6" line spacing (default).

ESC 3	.LT n	n/216" line spacing (n < 256).
ESC A	.LU n	n/72" line spacing (n < 86).

Paper Feed Execution/Print Head Control

Epson	Eprint	Action
LF	$l	Carriage return and line feed.
CR	$r	Carriage return only.
ESC J	.SP n	n/216" paper feed (n < 256). N.B. this does not give carriage return so to get this effect use $r before the next character to be printed.
ESC N) ESC O)	.PF n	Skip over perforation, n is the number of lines to be skipped (n < 128). n = 0 cancels.

Format Control

Epson	Eprint	Action
BS	$b	Backspace one character position.
ESC D	.TB n_1 n_2 ... n_k	Sets horizontal tab positions. 0 < n < 138, 0 < k < 33. N.B. first column is column 0 so if .TB 5 is set $t (see below) will start printing in the 6th print column from the left margin.

HT	$t	Horizontal tab.
ESC b	.VT n m_1 ... m_k	Sets vertical tabs (the m's) for vertical format unit number n. n < 8, 0 < k < 17.
ESC /	.VC n	Selects vertical format unit number n which must have been specified in a .VT command.
VT	$v	Vertical tab.
FF	.FF	Skips to top of next page.
ESC C	.PL n	Sets n lines per page (0 < n < 128).

Epson	Eprint	Action
ESC C 0	.PI n	Sets n inches per page (0 < n < 23).
ESC Q	.RM n	Sets right margin. See Manual for constraints on n. N.B. If you print a character in the rightmost column a carriage return + line feed will be output automatically.
ESC l	.LM n	Set left margin to column n. N.B. First print column is column 0.

Download Character

Epson	Eprint	Action
ESC &) ESC %) ESC :)	.DC nm a p_1 ... p_{11} .CR	This command sends to the printer all the instructions necessary to print a user defined character. .CR resets. Input text: .DC %% 139 38 9 64 9 240 9 64 9 38 0 0 this is % redefined .CR and now its % again prints as: this is ß redefined and now its % again

Miscellaneous

Epson	Eprint	Action
ESC 8) ESC 9)	.PE+ or .PE-	+ enables paper end detection - disables paper end detection.
ESC @	.ST	Initializes the printer.

Download Character

Epson	Eprint	Action
ESC &) ESC %) ESC :)	.DC nm a p_1 ... p_{11} .CR	This command sends to the printer all the instructions necessary to print a user defined character. .CR resets. Input text: .DC %% 139 38 9 64 9 240 9 64 9 38 0 0 this is % redefined .CR and now its % again prints as: this is ß redefined and now its % again

Miscellaneous

Epson	Eprint	Action
ESC 8) ESC 9)	.PE+ or .PE-	+ enables paper end detection - disables paper end detection.
ESC @	.ST	Initializes the printer.
ESC R		Selects international character set as follows:
	$a	American English
	$f	French
	$g	German
	$j	Japanese
	$k	Danish
	$n	Spanish
	$s	Swedish
	$u	UK English
	$y	Italian Input text: $a£$u50 prints as: #50
ESC U	.DI+ or .DI-	+ starts unidirectional printing - sets bidirectional printing.
ESC i	.IV+ or .IV-	+ sets incremental mode - cancels it.
ESC s	.HS+ or .HS-	+ sets half speed print - cancels it.

If you want a $ in the text or an underline or need to begin a line with a full stop then use $$, $_ and $. accordingly.

N.B. If $t begins a line and is needed to be followed by a full stop (no intervening spaces) insert the full stop with $. i.e. $t. should be t.

CONTINUED OVER

PROGRAM LISTING

```
   10dl%=59:dot%=229
   20DIM A% dl%,B% dl%,C% dl%,D% dl%,E% dot%,F% dot%,G%
 dot%
   30P%=1:U%=0:cr%=0:st%=1:sup%=0:sub%=0:text$="":eof%=
0:ln%=0
   40*FX6
   50PRINT "switch on printer and press return"
   60REPEAT UNTIL GET=13
   70INPUT "file to be printed " ft$
   80IF LEN(ft$)<1 OR LEN(ft$)>10 GOTO 70
   90file=OPENIN(ft$)
  100FOR I%=0 TO dl%
  110A%?I%=0:B%?I%=0:C%?I%=0:D%?I%=0
  120NEXT I%
  130FOR I%=0 TO dot%
  140E%?I%=0:F%?I%=0:G%?I%=0
  150 NEXT I%
  160REPEAT
  170READ N%
  180IF N%>dl% PROCerror("$ array element address too l
arge - element is ",N%)
  190IF N%<0 GOTO 210
  200READ A%?N%,B%?N%,C%?N%,D%?N%
  210UNTIL N%<0
  220REPEAT
  230READ N%
  240IF N%>dot% PROCerror("DOT array element address to
o large - element is ",N%)
  250IF N%<0 GOTO 270
  260READ E%?N%,F%?N%,G%?N%
  270UNTIL N%<0
  280VDU 2
  290VDU 1,27,1,64
  300REPEAT
  310K%=BGET#file
  320IF K%=ASC("$") PROCdollar:GOTO 390
  330IF K%=ASC(".") AND (cr%=1 OR st%=1) PROCdot:GOTO 3
90
  340IF K%=ASC("_") PROCuline:GOTO 390
  350IF K%=13 AND cr%=1 PRINT:P%=P%+1:GOTO 390
  360IF K%=13 cr%=1:P%=P%+1:GOTO 390
  370IF cr%=1 cr%=0:PRINT
  380st%=0:VDU K%
  390UNTIL EOF#file
  400VDU 1,13
  410VDU 1,27,1,64
  420VDU 3
  425CLOSE#file
  430END
  440DATA 0,0,36,0,0,6,2,84,0,0,7,3,83,0,0,8,2,84,0,0,9
,3,83,0,0,10,0,46,0,0
  450DATA 29,6,82,0,0,30,1,8,0,0,31,7,15,18,0,32,8,71,7
2,0,33,8,77,80,0
  460DATA 34,6,82,0,1,35,6,82,0,2,36,9,87,0,0,37,8,52,5
3,0,38,6,82,0,8
  470DATA 39,6,82,0,4,40,1,10,0,0,42,6,82,0,7,46,1,13,0
,0,47,6,82,0,5,48,1,9,0,0
  480DATA 49,6,82,0,3,50,1,11,0,0,53,6,82,0,6,54,8,69,7
0,0,59,0,95,0,0,-1
  490DATA 32,9,0,0,37,9,0,0,38,3,85,0,55,1,12,0,88,3,11
5,0,101,3,105,0
  500DATA 122,3,108,137,128,2,255,2,129,3,51,255,130,3,
65,85,154,2,57,0
  510DATA 155,9,0,0,158,4,67,22,161,3,67,127,162,3,33,6
3,167,3,112,0
  520DATA 182,3,81,137,191,9,0,0,195,3,74,255,199,2,64,
-1,212,3,47,7,229,9,0,0,-1
  530DEF PROCdollar
  540IF EOF#file GOTO 750
  550IF cr%=1 cr%=0:PRINT
  560K%=BGET#file
  570IF K%>96 AND K%<123 K%=K%-32
  580IF K%<36 PROCerror("unknown $ command in line ",P%
)
  590K%=K%-36
  600IF K%=7 OR K%=9 PROCchkflag
  610size%=A%?K%
  620char1%=B%?K%
  630char2%=C%?K%
  640IF char1%=0 PROCerror("unknown $ command in line "
,P%)
  650IF size%=0 PROCsc(char1%):GOTO 750
  660IF size%=1 VDU 1,char1%:GOTO 750
  670IF size%=2 VDU 1,27,1,char1%:GOTO 750
  680IF size%=3 VDU 1,27,1,char1%,1,N%:GOTO 750
  690IF size%=6 size%=9:GOTO 720
  700IF size%>9 PROCerror("size%>9 in 'dollar' data ele
ment ",K%)
  710IF size%>6 D%?K% = (D%?K%+1) MOD 2 ELSE PROCerror(
"3 < size% < 6 in 'dollar' data element ",K%)
  720IF size%>7 VDU 1,27
  730IF size%<>9 AND D%?K%=1 VDU 1,char1% ELSE IF size%
<>9 VDU 1,char2%
  740IF size%=9 VDU 1,char1%,1,D%?K%
  750ENDPROC
  760DEF PROCdot
  770IF EOF#file GOTO 1020
  780K%=FNcalccomm-715
  790IF K%<32 OR K%>229 PROCerror("unknown command on l
ine ",P%)
  800IF K%<>195 AND K%<>55 AND st%=0 PRINT:cr%=0:st%=1
ELSE cr%=0:st%=1
  810size%=E%?K%
  820char%=F%?K%
  830maxn%=G%?K%
  840IF size%=0 PROCerror("unknown command on line ",P%
)
  850IF maxn%>0 AND T%=13 PROCerror("number expected in
 dot command on line ",P%)
  860IF maxn%>0 N%=FNreadn:IF N%<0 GOTO 960
  870IF size%=1 VDU 1,char%:GOTO 960
  880IF size%=2 AND maxn%=0 PROCsw2(char%):GOTO 960
  890IF size%=2 AND char%=255 N%=N%+48:VDU 1,27,1,N%:GO
TO 960
  900IF size%=2 VDU 1,27,1,char%:GOTO 960
  910IF size%=3 AND maxn%=0 PROCsw3(char%):GOTO 960
  920IF size%=3 VDU 1,27,1,char%,1,N%:GOTO 960
  930IF size%=4 VDU 1,27,1,char%,1,0,1,N%:GOTO 960
  940IF size%=9 PROCspecial:GOTO 960
  950PROCerror("invalid size% in 'dot' data element ";K
%)
  960K%=T%
  970REPEAT
  980IF K%=13 OR EOF#file GOTO 1010
  990K%=BGET#file
 1000IF K%=13 P%=P%+1
 1010UNTIL K%=13 OR EOF#file
 1020ENDPROC
 1030DEF PROCuline
 1040IF U%=0 U%=1 ELSE U%=0
 1050VDU 1,27,1,45,1,U%
 1060ENDPROC
 1070DEF PROCchkflag
 1080IF K%=7 AND sup%=1 GOTO 1140
 1090IF K%=7 AND sub%=1 sub%=0:K%=6:GOTO 1140
 1100IF K%=7 sup%=1:N%=0:GOTO 1140
 1110IF sub%=1 GOTO 1140
 1120IF sup%=1 sup%=0:K%=8:GOTO 1140
 1130sub%=1:N%=1
 1140ENDPROC
 1150DEF PROCsc(char%)
```

```
1160IF cr%=1 cr%=0:PRINT
1170st%=0
1180VDU char%
1190ENDPROC
1200DEF FNreadn
1210IF EOF#file num%=-1:GOTO 1320
1220num%=0
1230REPEAT
1240T%=BGET#file
1250UNTIL T% <> 32 OR EOF#file
1260REPEAT
1270IF EOF#file eof%=1
1280IF T%>47 AND T%<58 num%=num%*10+T%-48:IF eof%=0 T%
=BGET#file
1290UNTIL T%<48 OR T%>57 OR eof%=1
1300IF maxn%>0 AND num%>maxn% PROCerror("invalid numbe
r in command on line ",P%)
1310IF T%=13 P%=P%+1
1320=num%
1330DEF FNcalccomm
1340LOCAL ct%
1350R%=0
1360FOR ct%=1 TO 2
1370T%=BGET#file
1380IF T%>96 AND T%<123 T%=T%-32
1390IF T%<65 OR T%>90 GOTO 1410
1400R%=R%*10+T%
1410IF T%=13 OR EOF#file GOTO 1430
1420NEXT ct%
1430IF T%=13 P%=P%+1
1440=R%
1450DEF PROCsw2(char%)
1460T%=BGET#file
1470IF T%=ASC("+") VDU 1,27,1,char%:GOTO 1500
1480IF T%=ASC("-") VDU 1,27,1,char%-1:GOTO 1500
1490PROCerror("unknown switch in dot command on line "
,P%)
1500ENDPROC
1510DEF PROCsw3(char%)
1520T%=BGET#file
1530IF T%=ASC("+") VDU 1,27,1,char%,1,1:GOTO 1560
1540IF T%=ASC("-") VDU 1,27,1,char%,1,0:GOTO 1560
1550PROCerror("unknown switch in dot command on line "
,P%)
1560ENDPROC
1570DEF PROCspecial
1580IF K%=32 PROCdc:GOTO 1640
1590IF K%=37 PROCcr:GOTO 1640
1600IF K%=155 PROCperf:GOTO 1640
1610IF K%=191 PROCht:GOTO 1640
1620IF K%=229 PROCvt:GOTO 1640
1630PROCerror("unknown command on line ",P%)
1640ENDPROC
1650DEF PROCdc
1660LOCAL ct%
1670VDU 1,27,1,58,1,0,1,0,1,0
1680VDU 1,27,1,37,1,1,1,0
1690VDU 1,27,1,38,1,0
1700FOR ct%=1 TO 2
1710REPEAT
1720K%=BGET#file
1730UNTIL K% <> 32 OR EOF#file
1740IF K%=13 OR (EOF#file AND I%<2) PROCerror("not eno
ugh data for DC command on line ",P%)
1750VDU 1,K%
1760NEXT ct%
1770FOR ct%=1 TO 12
1780N%=FNreadn
1790IF N%<0 OR (EOF#file AND ct%<12) PROCerror("not en
ough data for DC command on line ",P%)
1800VDU1,N%
1810NEXT ct%
1820VDU 1,0,1,27,1,37,1,1,1,0
1830K%=T%
1840ENDPROC
1850DEF PROCcr
1860VDU 1,27,1,37,1,0,1,0
1870ENDPROC
1880DEF PROCperf
1890N%=FNreadn:IF EOF#file GOTO 1940
1900IF N%=0 VDU 1,27,1,79:GOTO 1940
1910IF N%<0 OR N%>127 PROCerror("invalid dot command o
n line ",P%)
1920VDU 1,27,1,78,1,N%
1930K%=T%
1940ENDPROC
1950DEF PROCht
1960 LOCAL ct%
1970VDU 1,27,1,68
1980FOR ct%=1 TO 32
1990N%=FNreadn
2000IF N%<=0 OR N%>137 PROCerror("invalid tab setting
on line ",P%)
2010VDU 1,N%
2020IF T%=13 OR EOF#file GOTO 2040
2030NEXT ct%
2040VDU 1,0
2050K%=T%
2060ENDPROC
2070DEF PROCvt
2080LOCAL ct%
2090VDU 1,27,1,98
2100N%=FNreadn
2110IF T%=13 OR EOF#file PROCerror("invalid vertical t
ab command on line ",P%)
2120IF N%<0 OR N%>7 PROCerror("vertical tab format uni
t invalid on line ",P%)
2130VDU 1,N%
2140FOR ct%=1 TO 16
2150N%=FNreadn
2160VDU 1,N%
2170IF T%=13 OR EOF#file GOTO 2190
2180NEXT ct%
2190VDU 1,0
2200K%=T%
2210ENDPROC
2220DEF PROCerror(text$,ln%)
2230VDU 1,13
2240VDU 1,27,1,64
2250VDU 3
2260PRINT text$;ln%
2270CLOSE#file
2280END
2290ENDPROC
>
```

The new Electron from Acorn. Ask any child at school why it's worth £199.

Most British children have one thing in common with the new Electron microcomputer: they speak the same language.

You see, the Electron is the first micro remotely in this price range to use BBC Basic, the computer language that is rapidly becoming the standard in British schools.

But that's not all. Most children will feel at home with the Electron as soon as they lay hands on it.

This is because it has developed out of the Micro that has been chosen by over 80% of schools participating in the Government's current Micros In Schools project. It has a similar keyboard and has most of the functions of this much acclaimed (but naturally, more expensive) machine.

So now children will be able to continue their computer studies at home. They'll be able to use the same educational programs they use at school. And, if asked nicely, they'll be able to help willing adults take their first steps into computing.

All this for only £199.

A micro technology break-through.

And now a few reasons for adults why the Electron is such an exceptional machine at the price.

The Electron is neat and compact. Yet it is fast and powerful. (Full details, for the technically minded, are in the box opposite.)

It produces high quality sound using its own internal speaker.

And it offers a range of facilities many larger more expensive machines just cannot match.

For example the Electron's colour graphics have the highest resolution of any home computer.

This is because the chip that controls the graphics, specially designed by Acorn, is one of the most advanced of its kind. As a result, the Electron delivers twice as many characters across the screen as its closest competitor.

Built to last and to grow.

The Electron has been designed and built to be a permanent part of the family, year in year out.

Particular care has been paid to the keyboard. It is electric typewriter style: robustly constructed with a good, solid 'feel.' It has a space bar, and single entry keys for key commands.

In other words it's comfortable and easy to use, avoiding the need for the manual gymnastics sometimes associated with calculator style keyboards.

And it will grow with you via expansion modules, that Acorn are developing, to take peripheral additions such as printers and disc drives. So as your knowledge, interest and ambitions develop, the Electron can develop with you.

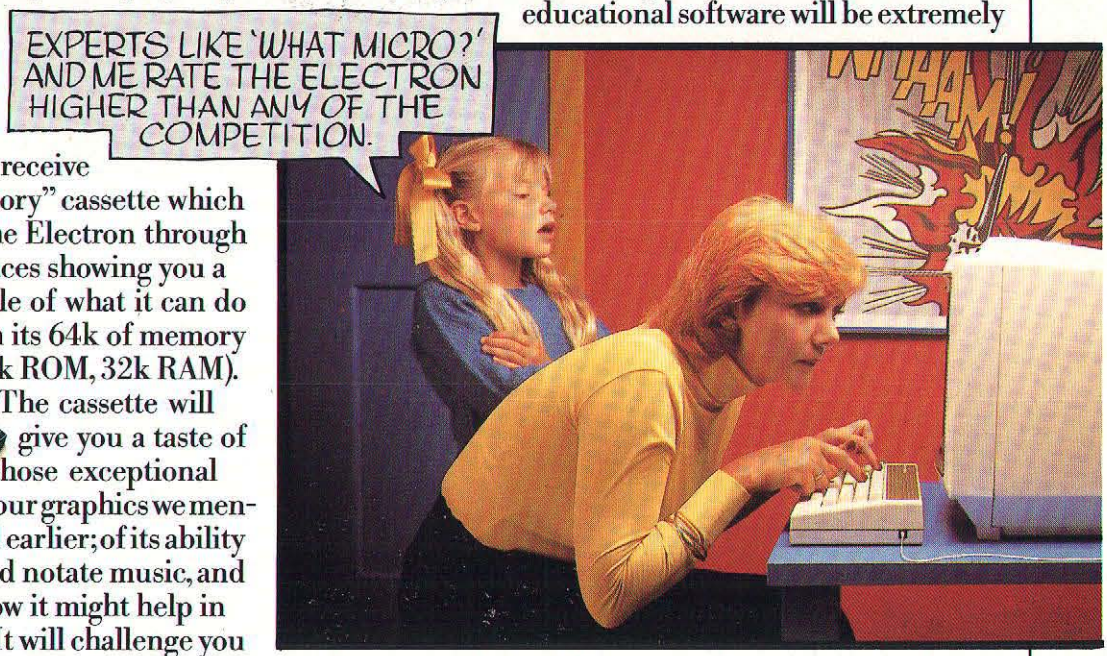
Additionally, to give you all the support you'll need to generate your own applications software, we've established a phone-in service attended by specialists to give advice, encouragement and practical help.

A gentle teacher.

The Electron plugs straight into virtually any TV set and cassette player so you will be

ready to go as soon as you get it home.

It comes not only with a comprehensive user guide, which describes the machine and its functions, but also with a book that takes you step by step through the basic principles of programming.



A free taste of its versatility.

You will also receive an "Introductory" cassette which will put the Electron through its paces showing you a little of what it can do with its 64k of memory (32k ROM, 32k RAM). The cassette will give you a taste of those exceptional colour graphics we mentioned earlier; of its ability to play and notate music, and show you how it might help in home accounting. It will challenge you to a few games and will, if you ask it, do your whole family's biorhythms in a matter of seconds.

You will in short, through the 15 separate programs it contains, get a glimpse of the Electron's potential. But only a glimpse, for that potential is as limitless as your own interest and imagination.

A widening range of software.

To help you realise some of that potential, Electron software already ranges from "Personal Money Management" through "Starship Command" to "Creative Graphics" (which, incidentally, includes some spectacular three-dimensional rotating shapes). Naturally, with its strong educational links, educational software will be extremely important for the Electron and even now O and A Level revision papers are being processed for Electron users.

How to get your Electron.

The Acorn Electron can be found at local Acorn dealers and major high street stores. However, if you would like to order one with your credit card, or if you would like the address of your nearest supplier, just phone 01-200 0200.

Technical Specifications

Hardware.
2MHz 6502.
32K ROM 32K RAM (64K total).
High resolution graphics 640 x 256 max.
Seven display modes.
8 colours and 8 flashing colours.
1200 baud CUTS tape interface with motor control.
Expansion bus for add-on interface modules.
Internal loudspeaker.
PAL UHF output to colour or black and white domestic TV.
RGB output for colour monitor.
56 key full travel QWERTY keyboard with spacebar.

Software.
BBC BASIC.
Extensions include interger, floating point and string variables, multi dimensional arrays: IF . . . THEN . . . ELSE, REPEAT . . . UNTIL, procedures with local variables.
Operating system allows plot, draw and fill commands.
Event timing.
Built-in assembler.
6502 assembly language can be mixed with BASIC.

The Acorn Electron.

Edsoft

Educational software is still an uncertain area for many parents and teachers. We clarify the issues and judge the products.

Title	**Titrations**
Publisher	**System Software**
Machine	**Model B**
Price	**£14.95**

One of the stated aims of this programme is, "To assist the teacher in supplying self help materials and remedial exercises to individual teachers." It achieves this very well indeed. The authors do not claim that this programme will teach the calculations associated with elementary titrations — that is the teacher's job. The programme has two options. Firstly acting as a calculator to check the pupil's answer from an actual experiment. What is wrong with answer cards or asking the teacher I hear you asking? Well, if the answer is incorrect the pupil is offered the option of trying again or working through the program step by step. The steps are: calculating the number of moles of the standard solution, identifying the mole ratio from the equation, identifying the number of moles of the unknown and thence calculating the concentration of the unknown.

The second option can present in excess of 300 problems on acid-base and acid-carbonate titrations at two levels of difficulty. The easy problems have 1:1 mole ratios with molarity the unknown quantity and the harder problems have 2:1 mole ratios and may have volume as the unknown. The problems use either hydrochloric acid or sulphuric acid and either sodium hydroxide or sodium carbonate. This is sound pedagogy when used as a remedial exercise not a limitation. It is possible for the user to make a dozen mistakes before the machine's patience is exhausted and it provides the answer.

The programme is easy to use with clear instructions on the screen for the pupil and clear, concise notes for the teacher. These notes give details of the range of answers accepted and the range of values of volume and molarity. The programme runs in MODE 6 and is therefore visually bland.

The second aim of the programme is, "To assist in the diagnosis of difficulties encountered by students . . ." I would have liked to have seen a record maintained of the pupils progress, the number of mistakes made and where the mistakes were made. This would provide a truly diagnostic tool. As it stands there is no feedback to the teacher and its diagnostic function is limited.

However it is still a very useful programme suited to any course involving elementary titrations, but at £14-95 a bit pricey.

Ratings Table:

SOUNDS / GRAPHICS	50%
DOCUMENTATION	90%
EDUCATIONAL	85%
VALUE FOR MONEY	75%
OVERALL	80%

Title	**Various Educational Games**
Publisher	**Dial Software**
Machine	**BBC 32K (Some Electron Versions) Cassette & Disc**
Price	**From £4.95 to £8.00**

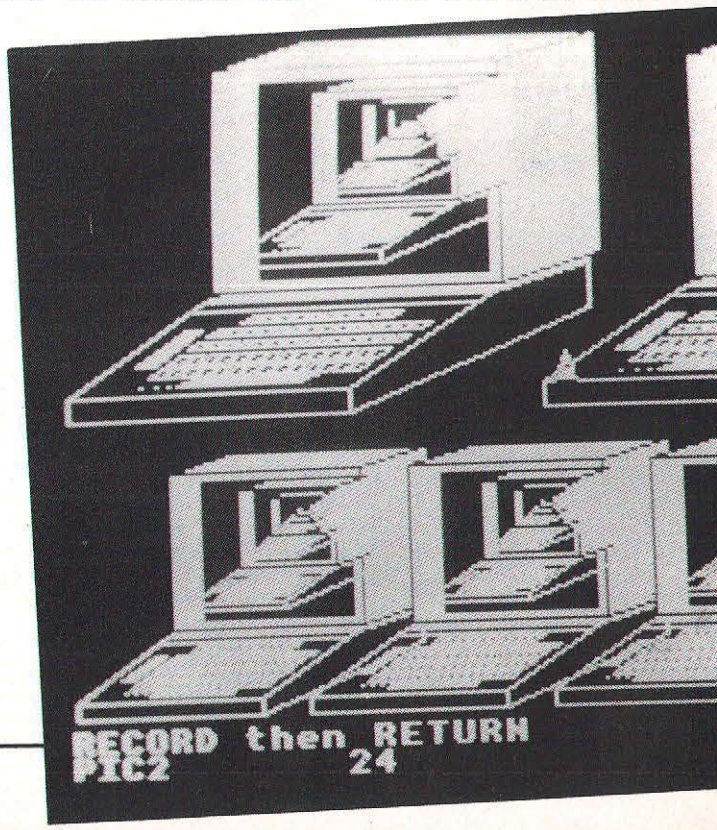
This company have a large range of over 30 programs of which I have been able to see and review over half. They are of a very mixed standard and I would advise you to see the program you are thinking of buying to see if it is one of the better ones. This may prove difficult though as these programs seem to be sold only by mail order. I can however recommend some as being well worth their money.

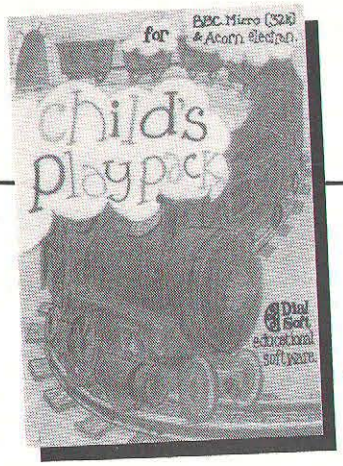
The best program in the set by far is the 32K LOGO which sells from £6.50 on cassette or £8 on disc. This is a very good implementation of turtle graphics although it is not by any means a full logo. It has a very wide command set including some simple provided functions (Squares, triangles etc.) and three variables besides SIZE, which affects defined functions. Defining new functions is very easy although the editor cannot be used to expand a definition once defined. There is support for arithmetic on the variables and it can even save and load screens to disc or tape. All told an extremely well thought out package and excellent value.

Another good program is TRIPUTE which is at the lower end of the price range. This is claimed to be a unique way to improve mental arithmetic involving addition and subtraction and revolves around three sets of three numbers. From these sets of numbers one has to calculate all possible addition and subtraction permutations and then decide which of the possible answers to these is shared by all three trios of numbers. Sounds complicated doesn't it but once you decipher the instructions (which do have a little more detail!) it is really very addictive and would increase the speed of calculation if used regularly.

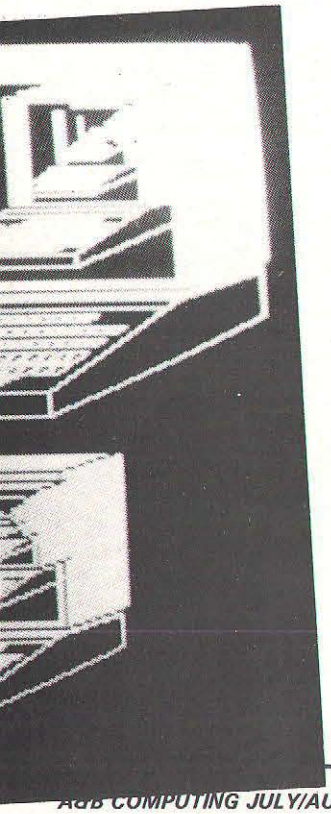
By contrast there is the CHILDPLAY PACK 1 which is very poor value for money indeed despite the fact that it contains four programs. Two of them are written so that they never finish which is not the best way to encourage or give children motivation to do more or better. Spell-away has a speech option but doesn't check to see if speech is actually fitted and so if you answer in error the program hangs up. Fractions is acceptable but nothing more I'm afraid. If all you wish to do is let your child play then this is a reasonable package but I can't recommend it's educational properties much.

Then there is the 'ODDS





ON' series. This is a case of a good idea being applied across the board for there are programs covering Monarchs, Writers, Inventors, Geography and Musicians. They are really sets of multiple choice questions held together and presented in a betting game format somewhat like a television quiz you may know. You have so much money and can bet on the answer you choose and depending how sure you are that you are correct you bet lesser or greater amounts. Unlike the quiz game the money won is purely notional but that doesn't prevent me from feeling that it is not the sort of program to play too much with young and impressionable youngsters unless you wish to suggest that gambling is not harmful, a point Gamblers Anonymous might well take issue with. There must be better ways to encourage learning and I'm not sure that the learning of facts, however interesting, is what 'education' is really about. If you really did want to buy all the programs in this series then you will end up buying the base program five times, I cannot see why they cannot market the driver program and then the databases for the subjects separately thus saving money in the long run.



Then there are those programs which aren't explained properly and rather go over one's head if you don't concentrate very highly. NUMBERHANG and GET THE MESSAGE fall into this category and I'm still not certain that I understand them fully, but perhaps I'm a little remedial or just too old for their subtleties. BASE 10 is a game meant to improve mental arithmetic and even has a high score table but I have reservations here too. To me the game is too fast, difficult to understand and doesn't have too good an educational concept either.

Finally I must mention BELLS, no not the whiskey, but a fascinating and enthralling program which allows the micro to simulate a church tower full of bells and a campanologists dream. Here you can choose from all the regular change ringing methods and add some of your own if you so wish. I cannot pretend to understand even 10% of what the program is doing or how to use it properly but to 'play' round is such good fun that I'm almost encouraged to find out more and discover what my playing around actually means. To say that this program is original is a vast understatement and you are even given permission to contact the author. Worth £4.95 of my money any day.

To reiterate what I said at the beginning these programs need to be seen to find out whether they fit your desires and educational Methods or philosophy. I would warn anyone against buying a program for the children if they don't know the methods etc that the school is using, for rather than encourage learning one is likely to sow seeds of confusion and doubt. The catalogue is well written though and the information about age range and game/education content is something other publishers could follow.

Ratings Table:

SOUNDS	50-90%
GRAPHICS	40-95%
DOCUMENTATION	50-70%
VALUE FOR MONEY	50-95%
OVERALL	40-100%

Title	**Angle Pack 2**
Publisher	**Peebee Software**
Machine	**BBC 32K Cassette & Disc**
Price	**From £17.50/ £19.95**

ANGLE PACK 2 is supplied on both cassette and disc and is actually made up of three separate sections. The Angle Tutor program is by far the largest and most comprehensive of the three and as the answers and methods it uses are needed for the others it is logical to use this first. The program has comprehensive instructions and even a flow chart to explain its operation. The aim is to teach the basic concepts of angles but unfortunately we are not told what the author regards these to be.

From the programs supplied I assume these to be angle estimation and recognition as by far the greatest amount of effort is put into these two areas. There are two teaching screens though one of which is your introduction to angles and comprises a circle in the centre and an angle, which you can vary at will, with a read out of its measurement and the resultant remainder. This is a good approach and has much to recommend it but from this we go immediately to Game One in which we must get as close to a specified angle as possible and score 100 points from 30 tries, there is no explanation of the scoring system at all, this seems a little long winded to me but some might like it. Success takes us to Game Two where we must guess the angle shown and then calculate the angle of the remainder of the circle. Failure takes you to Teaching Screen Two which is more basic than screen one and just shows the usual division of a circle eg 90 and 60 degrees. All told this is a good introduction but to me the games are not really encouraging the right parts of the concept as one is rarely asked to estimate angles in 'real life'.

The second part is POLYGON TUTOR and comprises one teaching screen and one game. The teaching screen allows you to display polygons of almost any number of sides (up to 1000, which is far too slow in my opinion anyway) and then see the number of triangles which are produced from the sides and that all the central angles add up to 360 degrees. It then asks about the addition of the angles in a triangle and the actual values in each of the polygons triangles. When you have had enough of this the game begins. This involves being shown a random polygon and asked to count the sides, triangles and the name of the shape in each case. This again is fairly good but wrong answers are penalised or, if in the counting, simply cause you to loop forever. The big failure of this part is the total lack of teaching about irregular polygons and some of the more exotic quadrilaterals, whilst not fatal in terms of its use in teaching, it does rather restrict it to only one part of the area.

The triangle tutor is similarly restricted in my view as it completely fails to use or teach the names of different type of triangle and concentrates solely on the internal angles and their calculation if you are given two of them. Overall this is a good but expensive introduction to the concept of Angles in their various forms but cannot be said to be comprehensive by any means.

Ratings Table:

SOUNDS	50%
GRAPHICS	80%
DOCUMENTATION	90%
VALUE FOR MONEY	70%
OVERALL	70%

CONTINUED OVER

Title	**Sploosh**
Publisher	**Highlight Software**
Machine	**Model B**
Price	**£6 cassette £7 disc**

This is one of seven programs at present available in the Read Right Away Series. If I say there is an arcade flavour about them, that's not meant in a derogatory sense, rather that they are the sort of games that will immediately appeal to children, and the graphics are superb!

Written by an educational psychologist (don't let that put you off either!), they are intended as part of a language program, and will be welcomed in any classroom where phonic work is taking place, particularly for those who have been turned off books — although I expect it'll be difficult to keep those who don't really need them away. There's a great deal of flexibility about the programs — number of players, skill levels, choice of sounds to meet individual needs.

SPLOOSH is a program that concentrates on vowel digraphs. The title page gives the option of going to the instruction page or not. This is followed by a skill level choice (1-5) — the higher the skill level, the fewer mistakes allowed; choice of 2-4 from 7 digraphs; and one or two players.

Each player is presented with a set of four diving boards consisting of words with vowel digraphs missing. Using his diver, a player has to select a vowel digraph and drop it into the appropriate word. A correct choice leads to a diving display, and four words completed by the end of the game leads to an accolade for the player's diver.

Other programs in the series include: LETTERBUGS, SORT-OUT, FIREFIGHT, PYRAMIDS, SPLASHDOWN, and MAGIC-E. Sound effects in all programs are most appropriate, but, unfortunately, the one option missing is sound level.

I suspect these are the sort of programs children will enjoy taking home in days to come for learning with these really is fun, and mums and dads will play with them after the children are tucked up in bed just for the pleasure of the graphics!

Highlight have a generous discount scheme for purchases of complete suites of programs, exchange discs for cassettes and accidently erased discs and cassettes for a nominal fee.

Ratings Table:

SOUNDS	80%
GRAPHICS	99%
DOCUMENTATION	on screen
EDUCATIONAL	85%
VALUE FOR MONEY	80%
OVERALL	90%

Title	**Teacher in the Custard**
Publisher	**Peebee Software**
Machine	**BBC 32K Cassette & Disc**
Price	**£8.50/£11.00**

As mathematical drill programs go, this has to be one of the worst I have ever seen and just look at the price. The program is boring, the graphics are poor to say the least and I'm not even sure that I like the concept of dropping teachers in custard, although I'm sure it will appeal to the murkier nature of most children's minds. Well what is it all about? you may ask. It is a simple practice program that generates random problems for a child to answer in the set time limit. The game can be used to set problems of addition, subtraction and multiplication or to set questions from a particular times table. The best feature of the program is without a doubt the teacher and options screens as they do at least mean that you can control it to work within quite specific limits. It will also store the score of any successful player but this is another flaw to my mind, teachers need to know how all the children are doing, especially those who are failing to finish the game for whatever reason.

The screen appearance is singularly unattractive and static which is unlikely to make it a real motivator for children. The teacher does end up in the custard but once again the graphics are crude and lifeless, I can't see this program being a rival for Killer Gorilla in any childs mind. Even the documentation contains spelling mistakes as does one of the teacher's screens. This company's motto is that they are 'About making learning exciting'. I cannot say that they get anywhere near with this offering.

Ratings Table:

SOUNDS	30%
GRAPHICS	20%
DOCUMENTATION	70%
VALUE FOR MONEY	10%
OVERALL	20%

Title	**Graphs Maths Tutor**
Publisher	**Salamander**
Machine	**BBC Model B and Electron**
Price	**£14.95**

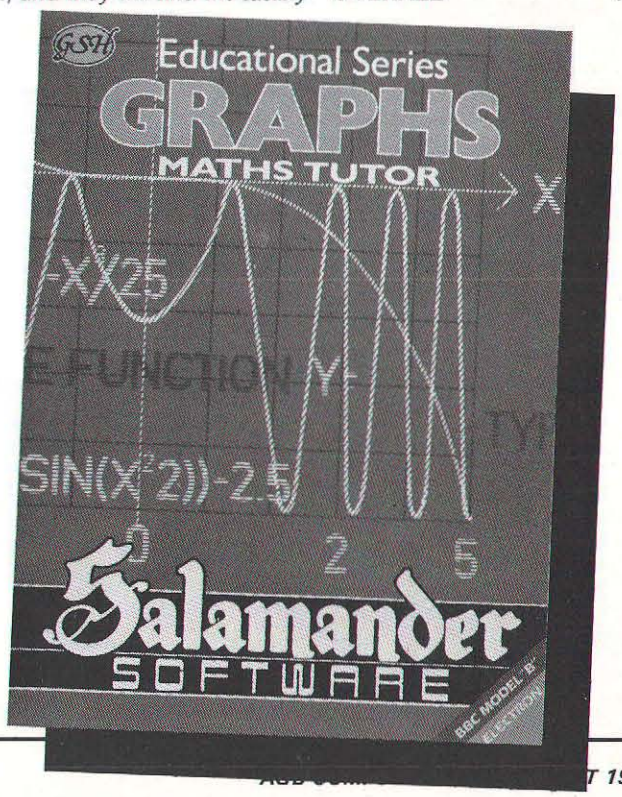
Everything about this program has been thought out very carefully, and the final result is a tape which will prove to be very useful both in schools and in private study at home. There will be many schools which will welcome such an extensive and thorough investigation of the subject, and they will find the facility to transfer these five programs to disc to be invaluable.

When I was studying 'O' and 'A' level maths, graphs were either charts drawn in books, or else inaccurate freehand attempts. This program animates the drawing process and removes the problem of shaky hands! A graph which can be evaluated by the relationship between X land Y can be easily input, and it will then be drawn on screen. These graphs may be exponantial or may include trigonometric functions. A 'quick-draw' feature allows a good approximation to be gained, and then suitable ranges for the X and Y axes can be given which will allow a more detailed plot to be made.

Parametric expressions are also covered, and then there are a series of tests which will give the student much to think about. The program will be very useful at 'O' level up to post 'A' level work.

Ratings Table:

SOUNDS	N/A
GRAPHICS	90%
DOCUMENTATION	100%
VALUE FOR MONEY	85%
OVERALL	90%



Title	**Play with Words**
Publisher	**Peebee Software**
Machine	**BBC 32K Cassette & Disc**
Price	**£8.50/£11.00**

This is an interesting educational program in that rather than being a ready to run package it is a utility or driver program ready to become a customised program to fit each persons needs. The basis of the program is a word, phrase or sentence structuring system. The idea is that you input a list or a paragraph of text and the student is presented with it in a scrambled order and has to reconstruct the original.

There are a number of applications for this kind of program but it shouldn't be over used. Obviously it can be used for logical reasoning, for problems in size or order and even for learning alphabetical order too. I was reviewing the disc version which allows up to ten files to be used at a session with each child, and it comes with 10 such files for you to try. The input routine is not all that it could be in that it doesn't give you the chance to correct any input after pressing return and therefore if your typing isn't too good it is easy to make mistakes and then have to start again.

The other major criticism that I have is its rather boring presentation, no graphics, minimal sound and therefore lack of motivational interest for the child. You also specify the order of presentation whereas I expected it to be on a random basis, I can see the reason for this but it does mean that there is a strict limit to the number of times a child can use the program before they have learned the order. The order is selected by pressing number keys but there is no error trapping to stop you trying a number that you have already used. A high score table is kept and can be saved to cassette or disc, but as it only keeps a percentage score it would be hard to use for diagnostic purposes which is a pity. The best way of describing it therefore is as a self marking exercise book and I can't really see it being much more despite the fact that it does work well in general.

Ratings Table:

SOUNDS	50%
GRAPHICS	N/A
DOCUMENTATION	80%
VALUE FOR MONEY	70%
OVERALL	70%

Title	**The Spanish Tutor Level A/B**
Publisher	**Kosmos**
Machine	**Model B/Electron**
Price	**£9.95 each**

Firstly let's make it clear that the Level A and Level B versions of The Spanish Tutor are in fact the same control program but that each tape contains a different selection of data files to use in conjunction with this control software. I think I would have preferred to have all the data files available on one tape and would have been willing to spend more on such a product. Kosmos decided otherwise and it does mean that if you only want to learn some vocab for your Spanish holiday then Level A will suffice, with its selection of everyday topics from vegetables and fruits to parts of the body and the weather (hopefully not to be a problem!)

Level B offers a further set of vocabulary files but also sets of adjectives, adverbs, conjunctions and prepositions, various tense forms of common verbs and some useful phrases. The choice of material over both tapes shows a good deal of thought and successfully jogged the memory as well as encouraging further work.

On entering the main program the two main alternatives are to load the datafile for your lesson or to create your own lesson. This latter alternative makes the program an excellent buy for schools as it allows for any number of files to be created, stored and retrieved. Full instructions are given.

When the chosen data file has been loaded the choice of display times is offered. The Spanish or English word is going to be displayed on the screen and it is necessary to choose for how long this will occur. If a value of 0 is entered for either then the word will not be displayed at all (so that you can self test without temptation to let the computer do the work for you!).

You must also choose which language is to be displayed first. You can ask for an automatic repeat of the lesson at this stage. These run-throughs merely display the word and it is up to the user to remember the meaning and judge whether it is learned or not. To test these assumptions there is a Test lesson. Here it is necessary to key in the answer and the program will judge your efforts. I particularly like the fact that an illegal character entry is countered by a beep from the computer and the fact that the end of the entry is automatically detected and the next question displayed. There are user defined characters for Spanish letters and punctuation marks.

An option to mix up the order and/or categories of words would have been nice although the association of like words does help with the process of remembering them. When the English form came first it was often impossible to tell whether the masculine or feminine version of, say, brother that was required. On Level B I especially liked the way that it became apparent that some Spanish adjectives can have more than one meaning, depending on context. Greuso, for instance, can mean thick, but when referring to people, fat. Other slightly differing English equivalents were included and served to promote the successful learning of these words. The Spanish Tutor proved a thoughtfully created package and should be a useful tool in Spanish learning for individuals and, in conjunction with other aids in school.

Ratings Table:

SOUNDS/GRAPHICS	N/A
DOCUMENTATION	90%
VALUE FOR MONEY	75%
EDUCATIONAL VALUE	80%
OVERALL	80%

Title	**Author**
Publisher	**Davy Computing**
Machine	**Model B**
Price	**£30.00 + VAT**

Davy Computing's Author program is supplied on 40 track disc and comes with an example program, a function key strip and a manual. The manual includes a step by step sample run through of using Author and this combines with the example supplied on disc to give the user a quick practical demonstration of what this interesting software can do.

The creators have opted for Mode 7 pages and at first glance Author appears to be another Teletext editor but with the advantage of random access filing applied to the storage of the individual pages. This, as we shall

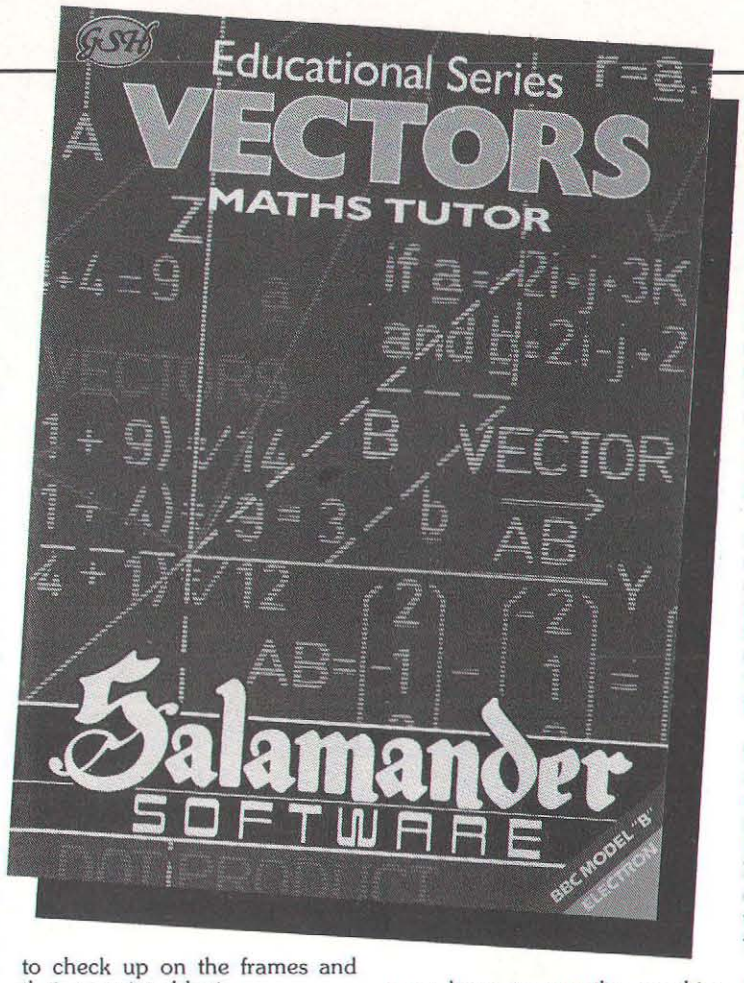
CONTINUED OVER

see, is not the case. The editing facilities do remind one of other Teletext packages available on cassette with various combinations of SHIFT, CTRL, and the function keys enabling and disabling Mode 7 features such as double height and separated graphics. The usual care has to be taken when designing a page, to account for control characters which lie hidden but affect all that follows on each row of this serial graphics mode.

The aim of the package is to provide a sort of electronic book with pages made available to provide information, instructions, various sorts of questions and so on. In the terms used by the Author program, the idea is to 'BUILD' a 'COURSE'. The basic building blocks available for this course are 'FRAMES', the pages of the book. Each frame is given a name and there are certain special frames which serve specific purpose within the course. The three most used frame types are information, multichoice and free format answer frames. Each frame is linked with another and the flow of the course controlled by the 'Frame Logic' of the program. As in any other computer program design, it is recommended that a flow chart be drawn to map out any intended course.

At the start of any run through, selections have to be made about what individual frames are to do and in which order they are accessed. it is also necessary to specify the special category frames. The 'control' frame can be returned to at any time during the running of a course by hitting function key 3. This is nominated at the beginning of building a course and you can therefore see the necessity for some form of forward planning.

From this point on it is a question of designing individual frames to suit the content, using the very comprehensive editing facilities which make colour and teletext graphics fairly easy to implement. To test out the flow of the course you have created, there is a Frame Management facility which allows the originator to check up on the frames and their associated logic.



Further important features include a Test Mode which can be turned on and off by the parent or teacher and which gives a score (allocated by the creator) to pupil's questions and gives a total at the end of a session.

There is also a 'logging' facility which allows a teacher to retrieve the actual answers given in response to questions on the course. The logging is turned on at the start of a session and a separate disc is required.

A typical run through starts with the logging of your name, entering the Start frame (if you don't know the name RETURN lists all frames) and away you go. The function keys are utilised once again (they are used for editing purposes) to provide fast access to the start and finish of the course and adjacent frames.

Author is an exciting piece of software. It is very simple to use at the basic level and anyone can soon learn to use the graphics and text facilities of Mode 7 to make the courses more attractive from a display point of view. There is no reason why the program should not be used for display only using information pages. The program unfortunately requires the availability of at least one disc drive but this hardware is now becoming widespread. Author consequently offers a fantastic opportunity to parents and especially teachers to use the computer as a resource in their particular field. The documentation is excellent and within a few minutes of loading the disc the ideas will begin to flow.

Ratings Table:

SOUNDS/GRAPHICS	N/A
DOCUMENTATION	85%
EDUCATIONAL VALUE	85%
VALUE FOR MONEY	50%
OVERALL	80%

Title	**Vectors Maths Tutor**
Publisher	**Salamander**
Machine	**BBC Model B and Electron (compatible)**
Price	**£14.95**

This is a well-designed suite of fourteen separate but linked programs which cover the requirements of the pupil studying 'O' or 'A' level Mathematics. It is a subject which lends itself rather well to the microcomputer, as vectors can be drawn on screen to illustrate the additive laws.

The programs being very simple with definitions of vectors, and illustrating the effects of scalar multiplication. After proving the triangle of vectors, the tape goes on to cover Cartesian coordinates and geometric vectors, and introduces matrix notation.

As I staggered my way through later programs, with memories of schooldays rather misty, I had several chances to demonstrate my confusion! However, the program proved to be helpful in the extreme, and I ended up with a considerably better grasp of the subject than I had to begin with.

I wish that this kind of tape had been available when I was taking my exams at school; it would have made revision at home a much more relevant experience. By the way, there are very clear instructions on transferring these programs onto disc — other software firms please note!

Ratings Table:

SOUNDS	N/A
GRAPHICS	80%
DOCUMENTATION	95%
VALUE FOR MONEY	80%
OVERALL	85%

Title	**Counting**
Publisher	**Cottage Software**
Machine	**BBC**
Price	**£9.50**

This 'program' in fact consists of four programs on two cassettes planned for 4 nd 5 year olds. Stated objectives are: ability to

make one-to-one correspondence; familiarise children with number symbols; matching number symbol to number symbol; and match number to amount shown. Documentation on screen and the duplicated sheet was adequate for the program.

COUNT 1. From one to five objects appear in white on the screen. A press of the space bar colours one object; too many presses produces failure. If correct a smiling face appears followed by a different group of objects; if incorrect a sad face appears and the same set of objects is repeated until the correct answer is supplied.

COUNT 2 is similar to the previous program, but after the one-to-one correspondences the number is slowly drawn on the screen and the child has to press the corresponding number key on the keyboard.

COUNT 3 Nought to five objects appear in random positions on the screen instead of being in a straight line and the child has to press the corresponding number key. Too large a number is not accepted; too small a number results in the sad face appearing.

COUNT 4 gives from nought to nine objects on the screen and works as Count 3.

My first reaction to this set of programs was that it didn't do much that couldn't be done as well using much of the structured apparatus already to be found in most nursery/infant classrooms — particularly as none of the programs offered any help to those in difficulty., The children disagreed! They enjoyed using it; it kept their attention well; and the language that was generated in the group as a result of the graphics and use of colour, I found fascinating. Perhaps we don't ask the children often enough!

Ratings Table:

SOUNDS	50%
GRAPHICS	70%
DOCUMENTATION	50%
EDUCATIONAL	60%
VALUE FOR MONEY	65%
OVERALL	60%

Title	**Hangman**
Publisher	**Microaid**
Machine	**Model B**
Price	**£7.95**

This is an educational game of hangman written to include a total vocabulary of 913 words. It uses the teletext graphics of Mode 7 to allow the inclusion of more words, and the vocabulary is comprised of the following: English Antonyms (148 words), English Synonyms (152 words), French (150 words), German (145 Words), Italian (149 words), Spanish (169 words).

Antonyms are opposites, and synonyms are words that mean virtually the same. These refer to the clues, which I will cover later on.

When the game is first run, a title page is displayed, and a menu of languages is shown, and the computer waits for the user to make his/her selection for language. Then the computer asks the user whether they wish to play a hard or easy game. In an easy game, the computer selects the word, and prints out a number of dashes to indicate the number of letters in the word. This is the same for all languages. Then, the screen is cleared, and depending on whether you hve chosen an easy or a hard game, you may be given the dashes to represent the letters at the bottom of the screen. Then the computer tells you to "Press "Y" if you want a clue." The clues that the computer gives depend on the language you have chosen. If the language is English, you will be given a synonym or antonym of the word the computer has selected. If you have chosen a language other than English, you will be given the English translation of the word that the computer has selected.

In the language options, there is a blank space for you to insert your own words or language. The program is written in BASIC, and is quite easily listable, and is packed full of very clear, colourful, Mode 7 REM statements that stick out like a sore thumb: ideal for someone who is trying to make his own additions to the program.

This game is excellent for schools who teach languages at all levels, as it provides a fun way of learning a normally quite boring part of the subject: vocabulary. The game itself is clear, easy to use and very colourful, and the clarity of the REM statements in the listing makes it very easy to add to the vocabulary. A highly recommendable program.

Ratings Table:

SOUNDS	35%
GRAPHICS	85%
DOCUMENTATION	N/A
VALUE FOR MONEY	85%
OVERALL	80%

Title	**Pick-a-Word**
Publisher	**Ega Beva**
Machine	**BBC (d & c)**
Price	**£11.95**

Pick-a-Word was the name on the outer package; Word Snap was on the cassette. So, I was pleasantly surprised to find that the first program matched the description of the picture mentioned in the short documentation included in the package.

The cassette contains five games — everything's a game these days! — chained from a title page and index. They are intended for children just beginning to read. The introductory part of the tape lists out the games and the words to be learnt and there are short, not very well presented, teachers' notes at the beginning of each game.

The programs teach short sentences using simple graphics to illustrate the words. First of all the programs show the subject to be described, then spell out the words to be used in the next part of the game. It also reminds the user of the object of the game — to identify the correct missing word to complete the sentence describing the picture on the screen. The correct word is selected by pressing the space bar; incorrect ones by pressing any of the alphanumeric keys. The score is kept on the screen and after each completed game pressing the space bar allows a re-run and any other key loads the next game.

I must admit I was put off the programs as soon as I saw red, pink and yellow elephants! Allowing for that, the vocabulary used and the rate of introduction is not very suitable for a beginner and the programs' value for those with more reading experience is really to increase their 'look and say' vocabulary by a relatively small number of words.

I found the lettering very fuzzy and would have preferred simple double height letters, which would link more closely with the script the children are likely to be introduced to in the early years of school.

At this point, I would like to make a plea to all programmers. Please, please put a sound on/off or sound level option in all your programs. If I hear 'Congratulations' or 'Oh dear, what can the matter be' again for six months...!

Some of the programming is 'sloppy': 1. "Whenever you want to choose another program, please press the BREAK key." If this is done, 'CH.""' appears on the screen. Unfortunately, the programmer appears to have forgotten that most schools will have the D.O.I. offer machine with disc interface fitted, so pressing BREAK returns the micro to the disc mode — and nothing happens! 2. When loading 'Game 1' from the index, the bottom half of the words 'Elephant' and 'Girl' disappeared. This did not happen when I ran it from disc. 3. "Errors are counted below the picture". For a program that seems to concentrate on use of prepositions, this is a strange one — in the programs I ran, errors and correct answers were counted above the picture! Save yourself £2 and buy their JIGSAW cassette — it'll keep your infants and juniors (and most of the staff) on their toes!

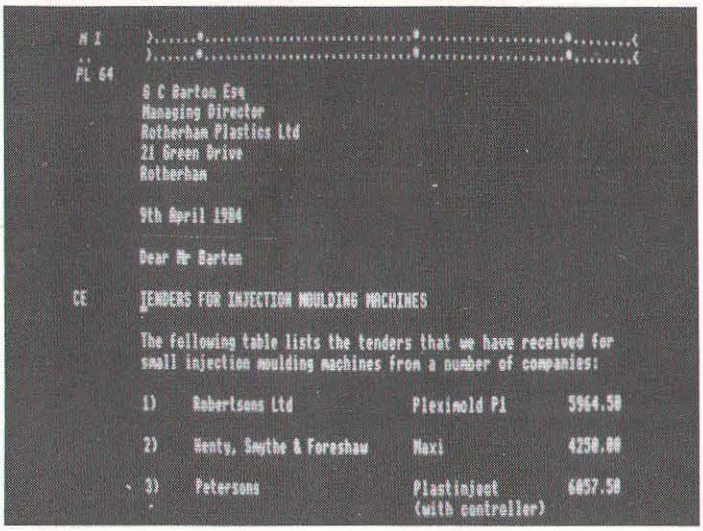
Ratings Table:

SOUNDS	40%
GRAPHICS	60%
DOCUMENTATION	40%
EDUCATIONAL	30%
VALUE FOR MONEY	30%
OVERALL	35%

Down to Business

Jon Vogler

Doing business on the BBC Micro. Which Wordpros are worth their salt?



EXPLANATIONS TO THE TABLE

The table attempts to assess the four programs for business suitability. This means they may be used by employees of average ability (with no interest in computing), under pressure to produce rapid, accurate work with a minimum of effort. A wide variety of standard tasks may be frequently repeated, with low operator concentration. In every function speed and ease are essential.

I have not considered tape-based systems as these are unsuitable for business use.

I have not tried to describe *how* the programmes are used, only what they will do for the user.

Numbers in brackets refer to the table item numbers.

40 OR 80 COLUMN?

Practically all business correspondence and stationery is on A4 paper which takes a line length of about 66 characters of a normal 10 or 12 pitch typewriter or printer. So printing needs "80 column mode" (up to 80 characters across the paper). All the programs offered this but WORDWISE and WORDSWORTH could only "edit", (ie change the text on the screen) in 40 column mode (4), so the user cannot actually see how it will print, while he is editing. With experience, or when doing simple tasks, this can be overcome but for the novice it may cause problems. VIEW can only hold in memory about 1500 words in 80 column text and the length of WORDWISE text that can be "previewed" on the screen in 80 column is similarly limited: a major drawback. SCRIBE has no such limitation.

In fact, because of its small memory, the BBC only just manages to perform as a business computer. SCRIBE overcomes this by exploiting discs to the full. The others can be enhanced by various memory "add-ons" now coming available. Aries, reviewed in A & B computing recently, is one such. It greatly increases the length of 80 column text that can be edited with VIEW. WORDWISE has to be returned to the supplier with £10 to exchange it for an 'Aries-compatible" chip. This allows far longer texts to be viewed in 80 column but does not increase the overall length of text that can be held in memory.

Creating tables (16) is especially difficult without 80 column editing and often business data needs an even wider display (5). A double page table used in this review was done, with great ease, using VIEW in 132 column width. None of the other programs could have done it!

Business computers use a monochrome (1 colour) green screen, which is cheaper and more restful to the eyes over long periods than a colour monitor. If, like WORDSWORTH, the program uses dark colours such as red, these often appear faint on the green screen (unless the brightness is unacceptably high). Good business programs avoid these colours (6). SCRIBE's brightening facility is especailly imaginative.

SPEED & EASE OF USE

Business users will have a standard page layout or "format" (7) for each document, which they will probably keep as a "template" on disc, to load afresh for every task. Thus ease of creating the format may not be vital but ease of altering it (eg indenting, justifying or altering line spacing) part way through (8) is always important. SCRIBE is especially weak on line spacing alterations. Also vital is to know where you are (9) in a long text. Losing text due to momentary loss of concentration may be disastrous. VIEW is specially bad in this: if you forget to depress the shift key when setting a marker you lose a whole line of text; if this happens to be one of the "rulers" that determine the format, serious confusion may result.

Speed of editing is greatly affected by the speed with which the cursor can be moved around the screen. More expensive business computers offer such options as the "mouse" or finger-touching the screen; on the BBC it depends on "tricks": combinations of keys. Only WORDWISE successfully tackles this so I use it alone for writing books and articles. WORDSWORTH fails because of poor "ergonomics", such as pressing the DOWN cursor arrow with (SHIFT), in order to move to the RIGHT margin; a combination no human can instinctively perform. Scolling (12) needs to be fast but infuriates when it shoots past the desired line and has to be brought back again. In edit mode, WORDWISE will scroll one screenfull at a time, the handiest arrangement, but in preview mode scolling control is most clumsy.

Markers (13) are especially important in business documents which may repeat the same phrase (eg name of a product or client) many times over. WORDWISE markers are far the quickest to set and manipulate and have the benefit that they remain after a COPY instruction, so this can be repeated, several times if necessary, without resetting them. They can be cleared at a single keystroke if the user programes the red keys accordingly and this flexibility (23), which can be applied in innumerable ways, is another enormous advantage which WORDWISE has over all its competitors. For example, in this article I am writing with four red keys programmed with the word-processor names (and the spaces before and after), one to clear the markers and three for underline, **bold-type** and **both together.**

PRESSING TIME

Tiny error corrections (14), such as swapped letters, wrong punctuation or spelling and omitted Capital letters are a constant time-drain for the business typist; even worse for the boss who tries his hands on the keys. Here word-processors score, but *only* if these can be made fast. Once again WORDWISE is supremely simple and rapid, as also in selecting the common routines (15) to SAVE text on a disc, PRINT it or LOAD it back again. The basic principle, that SUCH OPERATIONS SHOULD BE DONE

Name of Word-processor	Wordwise (1982)	View A1.4	Scribe V1.3	Wordsworth 0.04
BASIC DETAILS				
1 Produced by	Computer Concepts	Acornsoft	Merlin (Bucon Ltd)	Ian Copestake
2 Medium	ROM	ROM	ROM + Disc	Disc
3 Retail price (April 1984)	£39.00	£59.80	£59.95	£22.71
BASIC FACILITIES & EASE OF USE				
4 Can you edit in 80 column mode? (all offer 40 col edit if required)	No: "preview" only	Yes — up to 132 columns	Yes	No, preview only
5 Can you print wider than 80 columns?	No	Yes — up to 132	No	No
6 All data visible on a green screen at normal brightness	Yes, some are faint	Yes, all very clear	Yes, facility to brighten	Yes, some are faint
7 How easy to arrange page layout?	Easy for the numerical minded	Difficult until very familiar	Easy	Difficult
8 How easy to vary formats within text? (eg line spacing, indents, etc)	Easy	Easy but only at start of line	Difficult	Easy
9 How easy to keep track of text or scroll to correct place in text?	Easy in edit mode: hard in preview mode	Difficult, screen is "window" on text	Easy	Difficult
10 What risk of accidental text loss!	Almost nil	Easy to lose 1 line Chaos if ruler lost	Almost nil	Nil: good error checks
SPEED OF OPERATION — How fast to:				
11 — move cursor around screen and around text?	Specially speeded up cursor. Excellent tricks & controls	Slow but some tricks	Slow but some tricks	Slow, many tricks but hard to use
12 — scroll to desired line?	Fast & controlled	Tends to "overscroll"	Different (disc) system overscroll	Quite fast
13 — set markers, manipulate text, then clear markers	Very fast but user must program marker clearing	Moderate	Moderate	Slow due error checks
14 — make small text corrections	Fast and easy	Moderate; too many red-key commands	Moderate; many red key commands	Slow
15 — select functions: SAVE, LOAD, etc	Fast; excellent one-key-selected menu	Slow; commands have to be typed in	Slow; ponderous menu sequences	Menu ponderous; other means available
16 — create tables of data	Slow and difficult due to 40 col edit	Easy and fast but no decimal tab	Easy and very fast with decimal tab	Difficult due 40 col edit. Has decimal tab
SPECIAL FACILITIES — Will it:				
17 — continuously edit long documents?	No. Limited to 24562 letter memory	Yes. Only limited by disc capacity	Yes. Only limited by disc capacity	No. Limited by RAM, memory size unknown
18 — automatically merge texts held in memory	No	Yes, excellent system of macros, parameters	No	No
19 — automatically merge texts held on disc	Yes	No	Yes	Yes
20 — search but not replace word in memory	No	Yes	Yes	No
21 — "Wild" search (ie spelling uncertain)	No	Yes	No (promised)	Yes
22 — search, and/or replace, word on disc	No	No	Yes	No
23 — allow use of red keys for control commands or frequently used phrases	Yes	No — all engaged	No	No
24 — automatically do disc housekeeping	No	No	Yes	No
25 — print headers and footers	Yes	Yes	Yes	No
26 — automatically number pages	Yes — but limited	Yes — very flexible	Yes	No
27 — "spool" formatted text (eg to print on a computer with no word-processor)	Yes	No	Yes	No
COMBINATIONS WITH OTHER FACILITIES				
28 — Use with "Aries" RAM expansion?	Yes: if updated	Yes	Not necessary	Yes
29 — Can it be integrated with spreadsheet?	No	Yes, with VIEWSHEET	No (promised)	No
30 — Are "printer drivers" available to underline, bold type, etc.?	Not needed	Yes, (around £10)	Not needed	Yes (£8.62) but not normally needed
HANDBOOK				
31 — Is the handbook easy to understand?	Yes	Yes	Yes	No. Very difficult
32 — Is there an adequate index?	No	Yes	No (promised)	No
33 — Is there a summary list of commands?	Yes	Yes	No (promised)	Yes

CONTINUED OVER

WITH THE MINIMUM NUMBER OF KEY-STROKES should be engraved on the brain of every business programmer. Error-checking is not unimportant, but if it is time consuming it costs money; Business people become so adept at their work they make fewer and fewer errors as experience grows, so better to design the program for speed and merely ensure that errors can be recovered without serious loss.

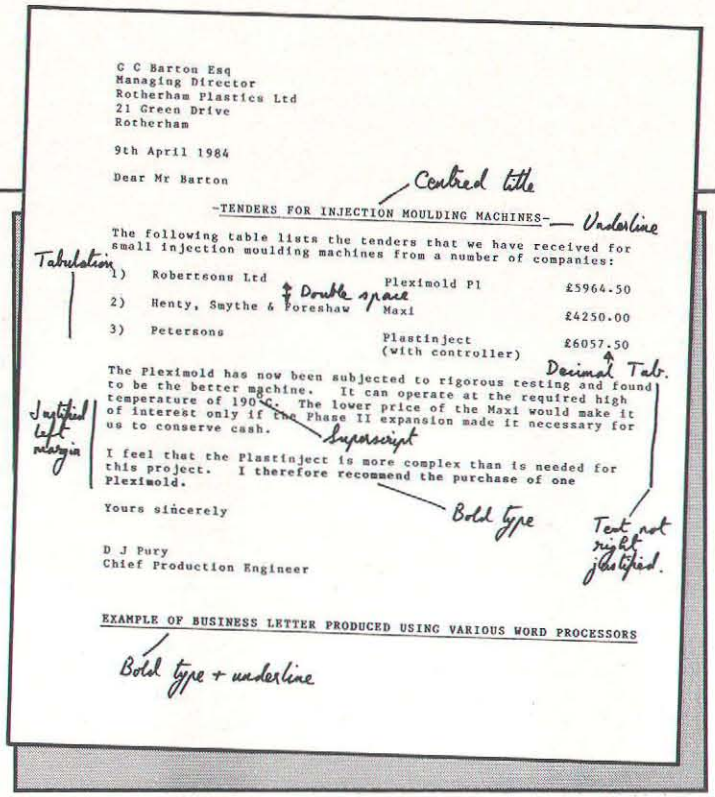
LONG DOCUMENTS AND REPORTS

For working on long documents, (17) by which I mean anything over about 3000 to 4000 words, SCRIBE is undoubtedly preferred. It is designed, like "dedicated" commercial word-processors, to use the discs continuously, whereas the others do most work in memory, (by which I mean of course memory in the processor) leaving the operator to SAVE text onto disc whenever desired. SCRIBE operates "disc-wise" at all times: it "housekeeps" them most efficiently, compacting, saving, backing-up with little prompting from the user; its word-searches cover the whole disc, not merely the processor memory as the others do. When, as is promised, it also has a "WILD" spelling option (21) (put a * or ? for any letter you are unsure of), as VIEW and WORDSWORTH do, the user will be able to operate a home-compiled spelling dictionary without expensive bought-out software full of words one has spelt correctly all one's life!

WORDWISE and WORDSWORTH will search-and-replace but will not merely search (20), find the word and allow you to go straight on with editing. Of course WORDWISE's glorious red keys enable the user to overcome this as well, by some dextrous key programming.

VIEW also will continuously edit long documents, and continuously print successive files. The pearls in its crown, which make VIEW the only choice for the business that writes multiple letters with standard variations, are "Macros" and "Parameters". None of the others have these; all they offer is the ability to call files from disc in the middle of printing a text. However, because they do not extend this to allow use of file "pointers" this is of limited value.

Report writing is not only a government, "big-business" or academic occupation; small firms of consultants, surveyors, solicitors also do it. Page numbering (26), printing of "headers" and "footers" (25 — short phrases at the head or foot of every page) and the ability to send text by post to another office, even if they do not possess a computer with the same word-processor (27) are all important in this respect. So is the ability to incorporate, in the printing operation, correctly page-numbered and formatted tables of calculations, performed on a "spreadsheet" program (29). None of the word-processors perform on all these points: VIEW is probably the best, in combination with VIEWSHEET, reviewed in this column last month. Database and spreadsheet to run with SCRIBE are promised shortly. Printing of any document is enhanced if underlining, bold-type and proportional spacing, plus a variety of type-faces and character sizes are available. How the word-processor handles these is dependant on the model of printer and sometimes a special "printer-driver" program (30) is needed whose availability and cost should be considered at the outset. This feature is dependant on the type of printer so I cannot do more than urge readers to insist on the dealer demonstrating which of these the word-processor + printer combination will perform.



C C Barton Esq
Managing Director
Rotherham Plastics Ltd
21 Green Drive
Rotherham

9th April 1984

Dear Mr Barton

-TENDERS FOR INJECTION MOULDING MACHINES-

The following table lists the tenders that we have received for small injection moulding machines from a number of companies:

1)	Robertsons Ltd	Pleximold P1	£5964.50
2)	Henty, Smythe & Foreshaw	Maxi	£4250.00
3)	Petersons	Plastinject (with controller)	£6057.50

The Pleximold has now been subjected to rigorous testing and found to be the better machine. It can operate at the required high temperature of 190°C. The lower price of the Maxi would make it of interest only if the Phase II expansion made it necessary for us to conserve cash.

I feel that the Plastinject is more complex than is needed for this project. I therefore recommend the purchase of one Pleximold.

Yours sincerely

D J Pury
Chief Production Engineer

EXAMPLE OF BUSINESS LETTER PRODUCED USING VARIOUS WORD PROCESSORS

Standard Word-processed letter

HANDBOOK

Finally, the program is only as good as the use the operator can make of it. Even an experienced operator may take several weeks to use a program's facilities to the full. A novice may take six months! A detailed and comprehensible handbook is not a luxury; it is essential. VIEW's two-part handbook (and all other Acornsoft business program handbooks) is excellent and sets the standard all software houses should follow. SCRIBE promise an improved handbook shortly. WORDSWORTH's handbook is congested, ill-organised and utterly incomprehensible. If in this review I have done the program itself any injustice, this is the reason. Ian Copestake tells me that the handbook is being rewritten. I would not advise anyone to buy the product until that has happened.

DIFFICULTIES

I have experienced two serious problems while assessing these programs:
WORDSWORTH intermittently failed to load, both the 80 track review disc and a 40 track disc bought by a friend. Ian Copestake has stated this must be due to disc imperfections, against which the product is guaranteed. SCRIBE consistently failed to load text files from disc drives 1 and 3. Bucon have explained that this may be due to interference from other ROMs, particularly VIEW, and are emphatic that there is no such bug in SCRIBE.

WHICH WORD-PROCESSOR TO BUY

If your main task involves:	Then buy:
— long documents, over 4000 words (unless your processor has a memory addition)	SCRIBE
— tables of data, especially over 80 columns wide	VIEW
— multiple letters with standard variations	VIEW
— routine office letters, records and short reports, where speed and ease for unskilled operators is vital	WORDWISE
— special repeat tasks, for which programming of the red keys offers time savings	WORDWISE

I cannot at present recommend purchase of WORDSWORTH.

BBC Computers in Control

Julie Mitchell

The BBC Micro comes out of its shell and extends an arm into the world of control.

So you have bought your computer and you are wondering how to utilise it to its full capacity, perhaps something a little more serious than simply playing games.

BRINGING YOUR BEEB TO LIFE

A computer can be likened to a human brain in that it is limited without the addition of a moving body. The science of control and robotics can be the moving body of your computer, that is, bringing the computer "to life".

The application of computers to control things is one of the most interesting areas and the potential is almost endless. There is a widespread acceptance that robots will, in the years ahead, become one of the most crucial aspects of industrial change, not only altering production procedures but also changing the lives of millions.

It is possible to identify four interactive parts involved with control:- the robot itself, the environment, the task and the computer or 'brain'.

THE ROBOT

The robot itself is a machine designed to perform a specific task. The robot will have several moving parts ie. degrees of freedom. Commonly five degrees of freedom plus the gripping action are present in a small robot designed to move objects, much as those seen in Cyber 310.

THE ENVIRONMENT

Robots relate to the surroundings in which they are placed. Robots that have a fixed position have their environment limited to the reach of the robot limbs, its working area. The environment must also take into account the physical properties of the surroundings and not simply the geometrical co-ordinates ie whether or not the robot is likely to knock into something.

CONTINUED OVER

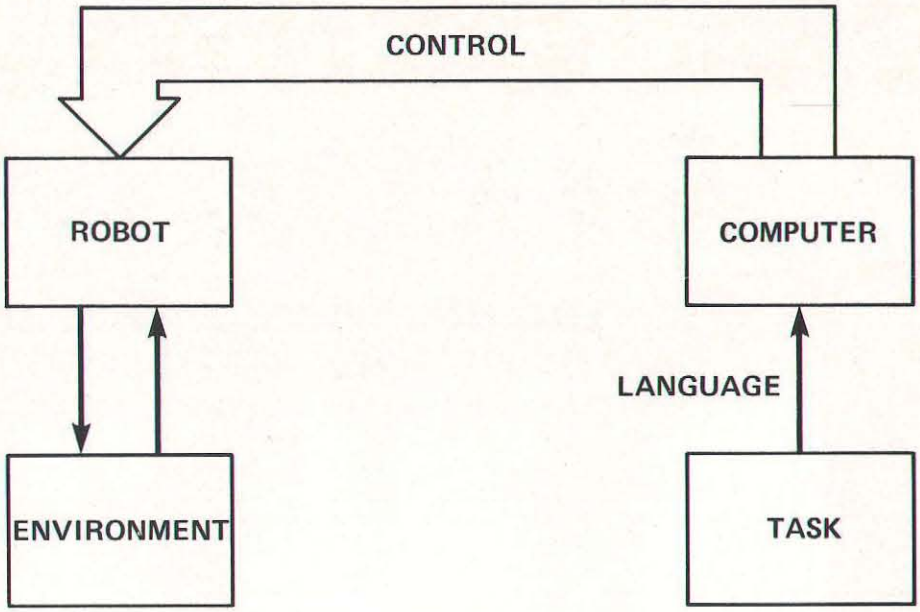


Fig 1

THE TASK

This can be defined as the difference between the initial starting position and the final position after the task has been completed. The task is usually described to the computer in an appropriate language.

THE BRAIN

Here's where your BBC Micro comes in. The computer or "brain" of the robot generates the control signals according to the prior knowledge of the task to be performed.

Ideally the computer is provided with the information about the robot and the data of the tasks to be performed and when it is in operation it should receive information concerning both the robot and the environments and then the computer developed its control over the robot causing it to move to its desired position.

At the present time, however, all the movements of the robot are determined beforehand and then fed into the computer in the form of a program.

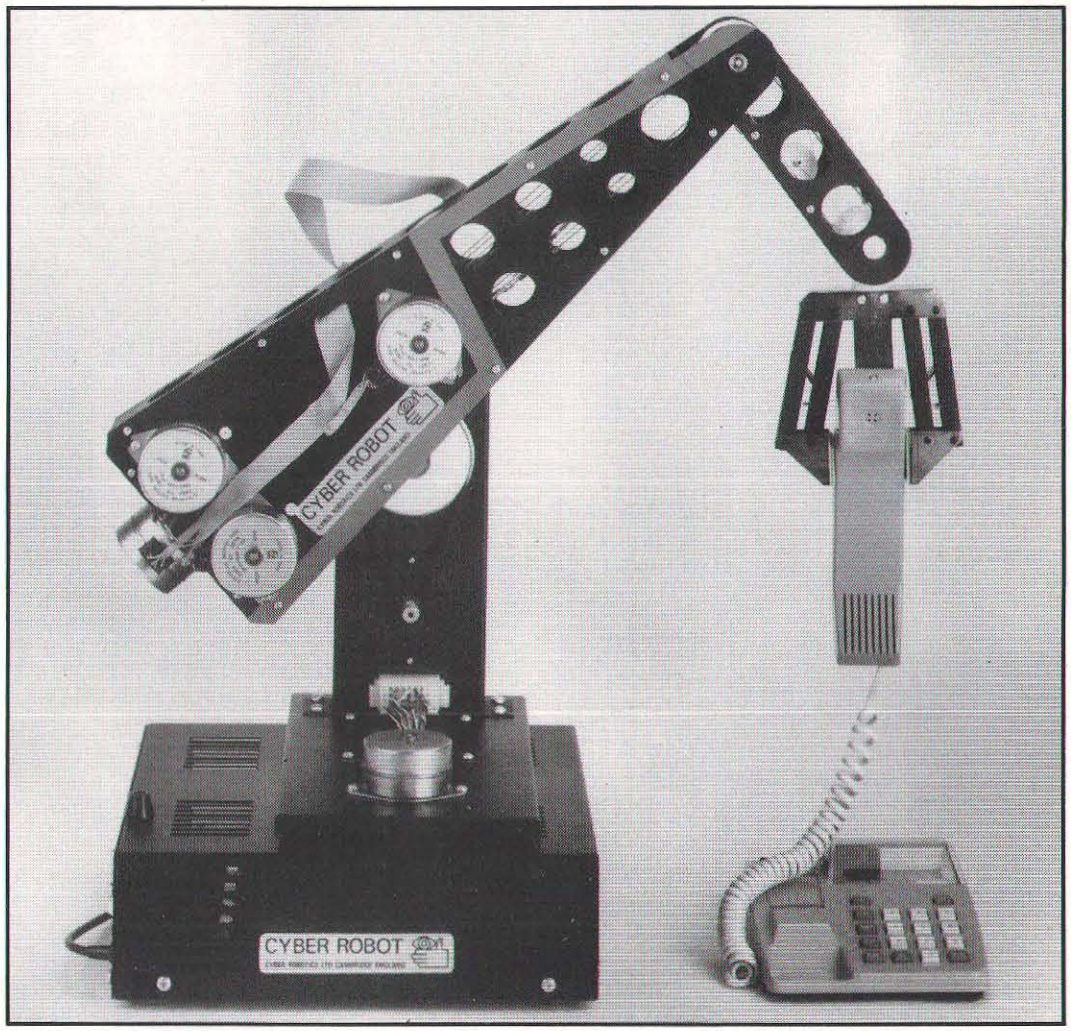
Without the addition of a nervous system it is difficult for the robot to adapt to the environment.

Consequently the main challenge remaining is not usually with the computer itself or even with the programs needed to get it to do the job, but rather the problems associated with getting meaningful information into and out of the computer from the environment to form a chain as in Fig. 1.

APPLICATIONS

The applications of robotics are numerous, for example, the ability to teach control at a low price and therefore the idea of robotics will appeal to anyone willing to experiment with computer motor control. Sooner or later anyone interested in the practical side of robotics will come across the need to exercise computer control over motorised systems.

Robotics is also a fun way to illustrate the true potential of a computer. In industry the use of robots as tools is slowly becoming acceptable and even before the end of the century their use will be vital for the survival of every manufacturer. Therefore the adaption of small training robots, much as the Cyber 310, will play an important role in the industrial transformation.



Julie Mitchell works for Cyber Robotics of Cambridge, whose robots are seen on Acorn exhibition stands around the world.

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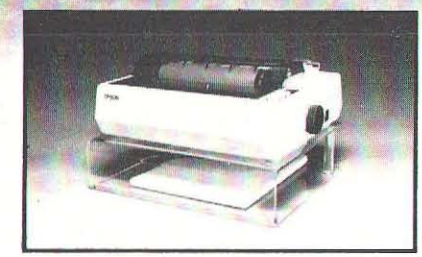

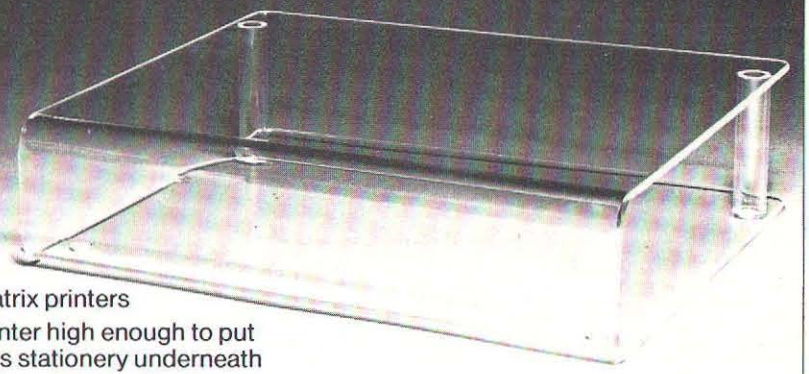

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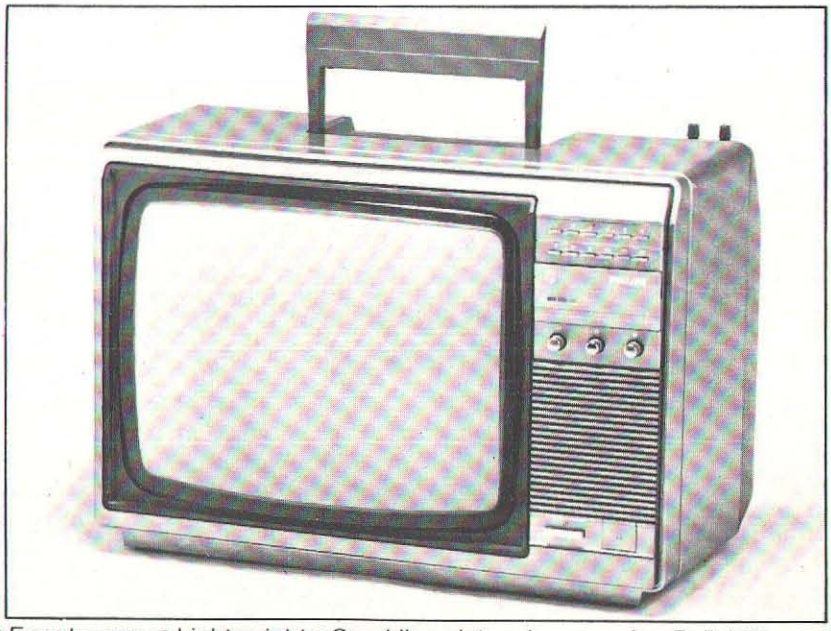

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Page Mode Switch

D Gibbons

Switch Page Mode on and off at any time.

It has often been pointed out how frustrating it can be, having done a listing in page mode, to find that page mode is still 'ON' when running a program. The usual solution is to program a function key to combine the CTRL/N, LIST and CTRL/O commands together so that page mode is automatically switched on and off.

DIRECT

The short machine code program presented here overcomes the problem in a more flexible and direct manner as it allows page mode to be turned 'ON' or 'OFF', at any time, even in the middle of a program or a listing. Such an operation is not normally possible until the listing is complete.

If a program is being listed normally, pressing CTRL/@ (which has no allocated function on the BBC Micro) at any convenient point will shift the listing into page mode and the listing can be stepped with SHIFT in the usual way. If a program is being listed in page mode then, when it stops at the end of a page, pressing CTRL/@ *before* pressing SHIFT will allow the listing to continue in normal mode.

HOW IT WORKS

The program works by setting the event vector to point to the block of machine code and then enabling keyboard events with *FX14,2. This code then uses OSBYTE calls 117 and 129 to check that CTRL is pressed and that @ (effectively via an INKEY (−72) is pressed. Bit 2 of the VDU status byte at &DO in zero page is then toggled by EOR'ing it with '4'.

If desired, the break key can be programmed to restore the event vector, and to re-enable keyboard events, by entering:

```
*KEY10
?&220=&A0:?&221=
&0D:*FX14,21:M
```

but if other commands, such as OLD, are also included in this definition, remember that the *FX14,2 must always be followed by ':M' rather than by ':' or it will not be recognised by the operating system. Finally, because this program makes use of certain features found only in OS 1.2, it will not work with OS 0.1.

PROGRAM LISTING

```
 10cona%=&DA0:osbyte=&FFF4        :REM Set up M/C location
 20?&220=cona% MOD 256            :REM Poke lo-byte into event vector
 30?&221=cona% DIV 256            :REM Poke hi-byte into event vector
 40FOR PASS=0TO3STEP3
 50P%=cona%:[OPT PASS
 60PHA:TXA:PHA:TYA:PHA            \Save A,X and Y registers
 70LDA#118:JSRosbyte              \Test if CTRL pressed
 80BCC dun
 90LDA#129:LDX#184:LDY#&FF
100JSRosbyte:CPX#&FF:BNE dun      \Test if @ also pressed
110LDA&D0:EOR#4:STA&D0            \Toggle bit 2 of VDU status byte
120.dun PLA:TAY:PLA:TAX:PLA:RTS          \Restore all registers
130]NEXT
140REM Now enable keyboard events
150*FX14,2
160END
```

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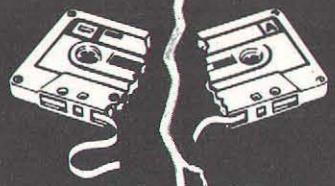

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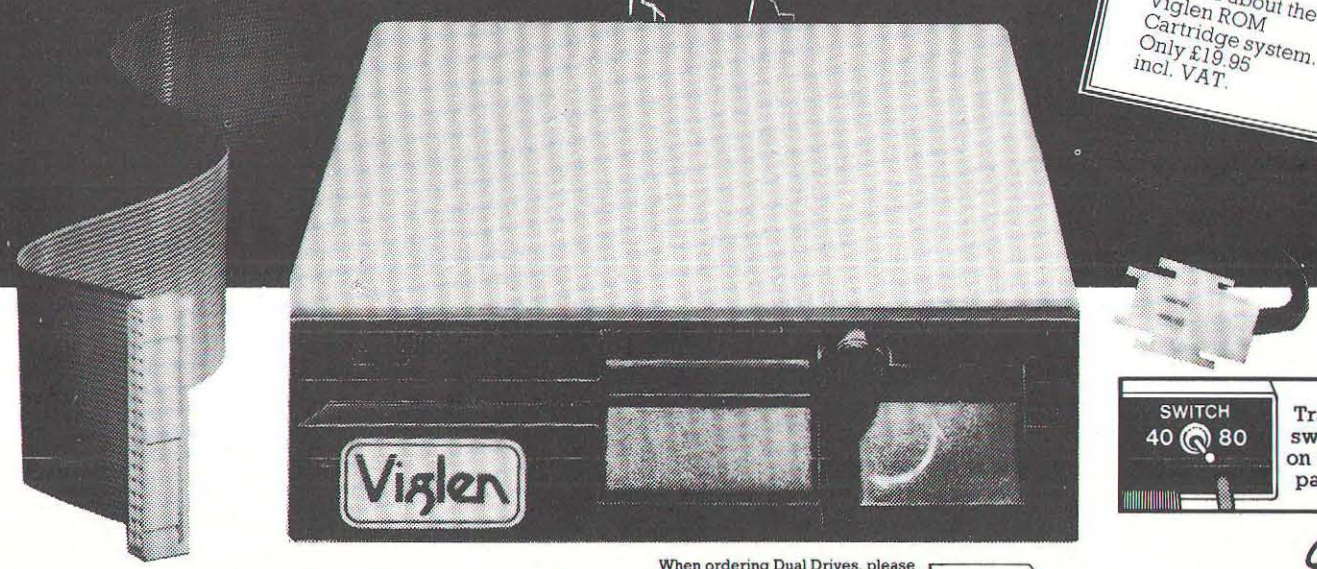

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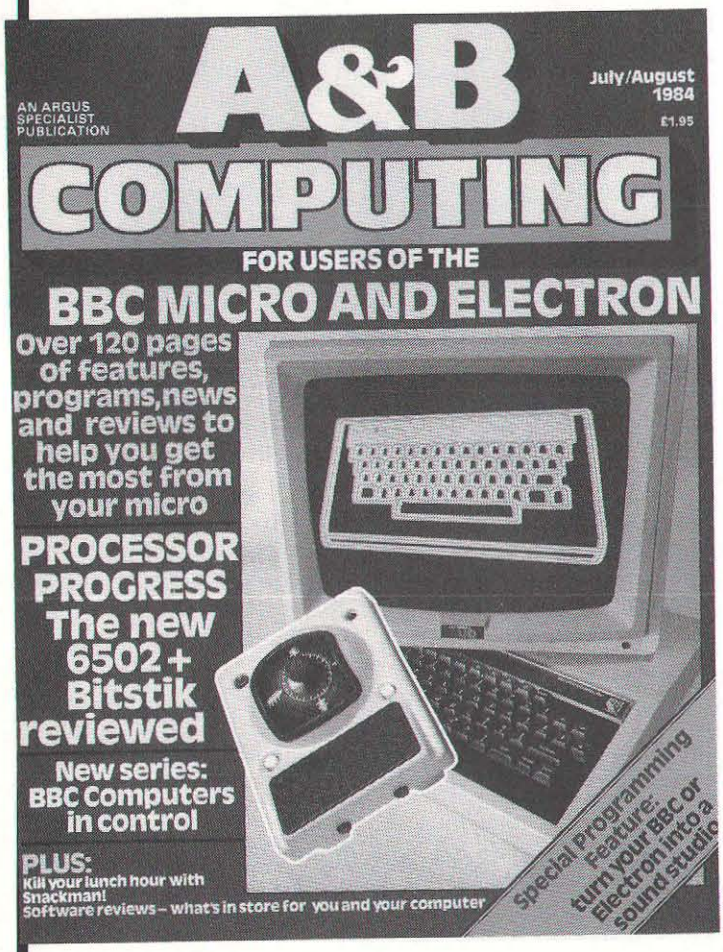

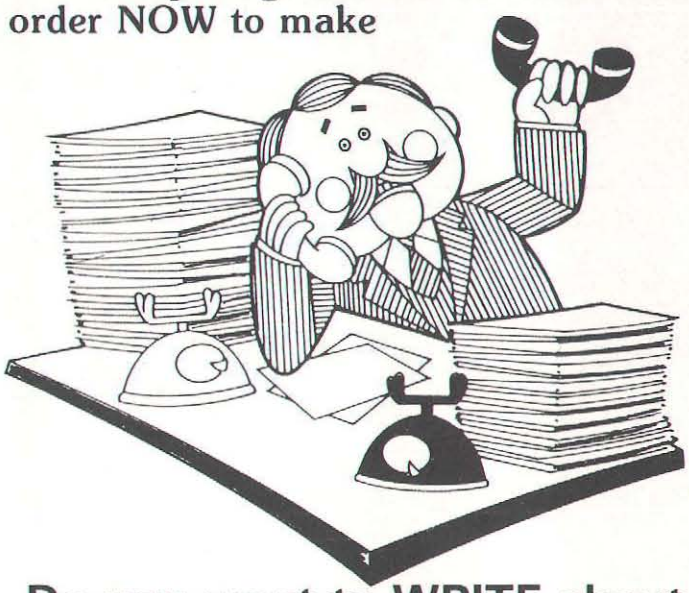

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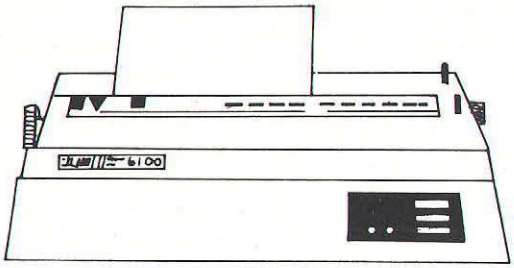

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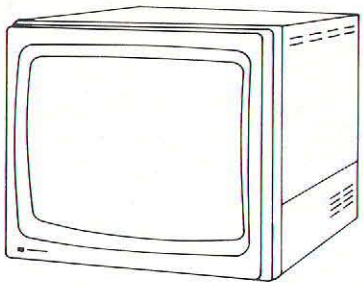

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Europe

R. Kitching

Combine an education in filling irregular shapes on your BBC or Electron with an extensive test of your knowledge of our European neighbours.

The BBC Micro does not have a FILL command like some of the other micros, but Beeb's fitted with the 1.2 operating system have a range of PLOT commands which allow filling to be performed. The number for the PLOT command are in the range 72 to 79. Using PLOT77 a line is drawn in the current foreground colour easily filled. To fill an irregular shape it is first necessary to draw the shapes outline, this can be done in any graphics foreground colour, program 1 performs this task.

```
 10 REM DRAW IRREGULAR SHAPE
 20 MODE2
 30 MOVE550,100
 40 REPEAT
 50 READ A%,B%
 60 IF A%>1PLOT5,A%,B%
 70 UNTIL A%=1
150 DATA 200,400,300,550,100,700,550,900,1100,800,700,
    600,1000,340,800,300,550,100,1,1
```

IRREGULAR FILLING

In program 1 READ and DATA statements are used to hold and obtain the information for each turning point of the shape with the PLOT5 command being used to draw each line. Running the program draws the irregular shape in the centre of the screen. To fill in this shape or draw it originally using filled in triangles i.e. PLOT80 to PLOT87, would be quite difficult but using PLOT77 it becomes an easy task. Program 2 can now be added to program 1 which when RUN will fill in the shape in the colour of blue.

```
 80 REM FILL IN SHAPE
 90 GCOL 0,4
100 X%=550
110 FOR Y%=100 TO 900
    STEP 4
120 PLOT77, X%,Y%
130 NEXT Y%
140 END
```

The PLOT77 command works by moving to the point set by X% (X co-ord) and Y% (Y co-ord) and plotting a line horizontally in each direction until a pixel set to a foreground colour is met. If a foreground colour is not met then the plotted line continues up to the edge of the screen. To fill an area it is necessary to use a FOR-NEXT loop with STEPS of 4 (the vertical height of a graphics pixel) from the lowest position to be filled to the highest. This is done in the program at lines 110 and 130.

The filling of the shape produced in program 1 works by using only one FOR-NEXT loop due to the lowest and highest points on the shape being at the same position on the X-axis, that is 550. If we change the DATA held in line 150 to make the highest point at 200 on the X-axis,

NEW DATA LINE . . . 150
DATA 200,400,300,550,100,
700,200,900,1100,800,700,
600,1000,340,800,300,550,1,1

Running the program you will see that a triangle at the top of the shape has not been filled and unwanted filling has occured at the top right of the screen. To fill a shape of this type it is necessary to use two FOR-NEXT loops, the value of X% being changed for each loop to equate to the value of the X-axis where the lowest and highest points occur i.e. at 550 and 200 in this case. This is shown by modifying the existing program with the following lines:

```
 95 X%=550
100 FOR Y%=100 TO 800
    STEP 4
105 PLOT77,X%,Y%
110 NEXT Y%
115 X%=200
120 FOR Y%=804 TO 900
    STEP 4
125 PLOT77,X%,Y%
130 NEXT Y%
```

The new program now fills in the whole of the shape. If the shape is even more irregular it will be necessary to use several loops, each resetting both X% and the range of the loop to cover the lowest to the highest points on the X-axis.

Any colour may be used to fill the shape, try adding the following lines to the program.

```
102 IF Y% MOD 20=0
    GCOLO,RND(15)
122 IF Y% MOD 20=0
    GCOLO,RND(15)
```

Running the program should display a multi-coloured shape.

GEOGRAPHY QUIZ

Program 3 demonstrates these techniques, it is a geography quiz, which starts by drawing a high resolution map of Europe by using the method shown in program 1 this is PROCMAP then fills in each land mass by using the method shown in program 2 this is PROCFILL. After drawing the map 40 questions are given on the location of each country on the map, an asterisk is flashed over the country which requires to be named. A choice of four countries are given as the answer and the answer is entered by typing the number of the country. The number of correct answers are indicated and the highest score is maintained.

To help to understand the operation of the Europe program the following is an explanation of each line within the main program, variables and procedures used.

MAIN PROGRAM

LINE
1 Sets Mode and dimensions arrays.
2 Redifines colours using VDU19 command and turns off cursor.
3, 4 Prints title and draws boundary for map.
5 Calls PROCMAP and using data from lines 54 to 64 draws coastline of Europe.
6 Sets foreground colour to green and resets data pointer to access correct fill information.
7 Reads data from lines 70 to 72, each time calling PROCFILL to fill each land mass.
8 Sets foreground colour to white, read data from lines 65 to 69 then calls PROCMAP to draw each country's border.
9 Draws Sea of Marmara.
10 Defines text window.
11-18 Sets up a loop for 40 questions.
12,13 Prints score at top of screen and question heading.
14 Calls PROCCHOSE to select a country for the question.
15 Sets foreground graphics colour to black-white flashing using GCOL3 to allow easy erasing.
16 Calls PROCQUEST to select a choice of answers, prints and asks the question.
17 Erases the asterisk printed at line 15.
19 Informs quiz finished and prints final score.
20 Prints high score.
21 Prompts for another go.

PROCEDURES

LINE
23 PROCINIT
23 Sets all countries' arrays to a null and sc% to zero.

24-25 PROCFILL
25 Uses PLOT77 to fill the area as set by X% on the X-axis and A% to B% on the Y-axis.

26-32 PROCCHOOSE
27 Randomly chooses a number between 73 to 112 and restores data pointer to this line.
28 Reads information from data line.
29,30 Routine to check if country chosen has been used before, if it has YES% is set to 1 as a flag.
31 If YES% = 1 returns to line 27 to choose another country.

33-48 PROCQUEST
34 Set P% to a random number either 1,2,3 or 4.
35-44 Loop used to select four countries.
36 Randomly chooses a number between 73 to 112 and restores data pointer to this line.
37 Reads information from data line.
38-41 Routine to check if country chosen is the same as the one chosen in PROCCHOSE or one of the countries already selected for this question.
42 Prints the countries number within the question.
43 Prints the country chosen or the country chosen in PROCQUEST if J% = P%.
45 Prompts for an answer, ANS%.
46 Checks to see if answer given is correct, prints suitable comment then updates score.
47 Gives delay to allow comment/answer to be seen.

49-53 PROCMAP
50 Reads co-ordinates for PLOT command and plots line if greater than 1.
51 If co-ordinates equal 0 then reads data again and moves graphics cursor to new co-ordinates.

DATA

LINES
54-64 Coastline of Europe.
65-69 Borders of each country.
70-72 X-axis, lowest and highest Y-axis positions for filling.
73-112 Country's name and its X and Y position on the map.

VARIABLES

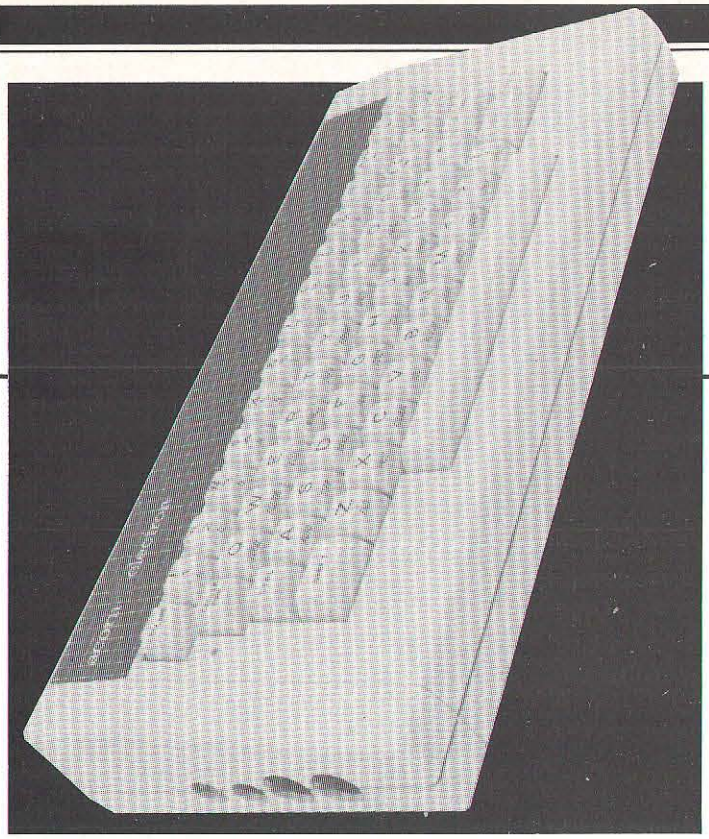
N$(40) Array for each country selected in PROCCHOSE.
R$(4) Array to hold the four countries chosen in PROCQUEST.
hsc% High score.
sc% Score.
A% Used in PROCFILL as the lowest Y-axis position.
B% Used in PROCFILL as the highest Y-axis position.
X% Used in PROCFILL as the X-axis position and in PROCCHOOSE as the X position of the country chosen.
I% Loop variable for the question.
Y% Y position of the country chosen in PROCCHOSE.
F% Loop variable used in PROCFILL.
R% Line to be read in PROCCHOSE.
C% Dummy variable to keep a count of times taken around REPEAT UNTIL loop in PROCCHOSE.
T% As C% except in PROCQUEST.
YES% Set to 1 if country has previously been selected in PROCCHOSE and PROCQUEST.
J% Loop variable used in PROCQUEST.
P% Number of correct answer.
ANS% Number given as answer.

PROGRAM LISTING

```
0REM EUROPE by R.KITCHING OCT/83
1MODE1:DIMN$(40),R$(4):hsc%=0:PROCIN
IT
2VDU19,0,4,0,0,0,19,1,2,0,0,0,19,2,0
,0,0,0,19,2,8,0,0,0,23,1,0;0;0;0;:COLOUR
128:CLS
3PRINTTAB(12,1);"EUROPE"
4PLOT1,1000,0:PLOT1,0,950:PLOT1,-100
0,0:PLOT1,0,-950
5RESTORE54:PROCMAP
6GCOL0,1:RESTORE70
7REPEAT:READA%,B%,X%:PROCFILL:UNTILA
%=0
8GCOL0,3:RESTORE65:PROCMAP
```

CONTINUED OVER

```
 9GCOL0,0:MOVE764,164:PLOT1,44,24
10VDU28,32,31,39,0
11FORI%=1TO40:CLS:COLOUR1
12PRINT';sc%;" right"''"Question    "I
%
13COLOUR2:PRINT'"********NAME""THE"'
"COUNTRY ********":COLOUR3
14PROCCHOSE
15GCOL3,3:VDU5:MOVEX%,Y%:VDU42,4
16PROCQUEST
17VDU5:MOVEX%,Y%:VDU42,4
18NEXT
19A=INKEY(200):CLS:PRINT''''"You""ha
ve""finished"''''"You""scored"'';sc%;"
right"''I%-sc%-1;" wrong":IF sc%>hsc% hs
c%=sc%
20PRINT'"Best""score ";hsc%
21PRINT"PRESS Y""TO""REPEAT"''"OR"'
'"N TO END"
22REPEAT A$=INKEY$(0):UNTILA$="Y" ORA
$="N":IFA$="Y" PROCINIT:GOTO11 ELSE END
23DEFPROCINIT:FORI%=1TO40:N$(I%)=" ":
NEXT:sc%=0:YES%=0:ENDPROC
24DEFPROCFILL
25FORF%=A%TOB%STEP4:PLOT77,X%,F%:NEXT
:ENDPROC
26DEFPROCCHOSE
27R%=RND(40)+72:RESTORE R%
28READN$(I%),X%,Y%
29C%=-1:REPEATC%=C%+1:IFN$(I%)=N$(C%)
 YES%=1
30UNTILI%=C%+1 OR YES%=1
31IF YES%=1 YES%=0:GOTO27
32ENDPROC
33DEFPROCQUEST:VDU23,1,0;0;0;0;
34P%=RND(4)
35FORJ%=1TO4
36S%=RND(40)+72:RESTORE S%
37READR$(J%):YES%=0
38T%=-1:REPEAT T%=T%+1
39IFR$(J%)=N$(I%) OR R$(J%)=R$(T%):YE
S%=1
40UNTILJ%=T%+1 OR YES%=1
41IFYES%=1 GOTO36
42PRINTJ%
43IF J%=P% PRINTN$(I%) ELSE PRINTR$(J
%)
44NEXT
45INPUT'ANS%:IFANS%<1ORANS%>4THENPRIN
TCHR$11;"          ";:VDU7,13,11:GOTO45
46IFP%=ANS% THEN PRINT"CORRECT":sc%=s
c%+1 ELSE PRINT"WRONG""it is";N$(I%)
47A=INKEY(200)
48ENDPROC
49DEFPROCMAP
50REPEAT:READA%,B%:IFA%>1PLOT5,A%,B%
51IFA%=0 READA%,B%:MOVEA%,B%
52UNTILA%=1
53ENDPROC
54DATA0,0,625,950,465,790,450,700,470
,675,530,700,540,650,550,580,570,592,580
,616,584,600,608,645,608,670,640,708,616
,732,630,775,685,880,720,872,724,850,670
,792,670,730,700,708,756,725,756,708,772
,708,700,684,700,656
55DATA716,656,700,624,672,640,664,624
,664,572,632,548,616,564,550,540,548,556
,500,556,488,580,495,610,505,616,510,625
,500,630,500,655,460,616,472,608,464,560
,440,550,400,550,370,505,330,495,280,465
,265,490,254,490,245,460,220,480
56DATA200,470,232,416,240,380,216,320
,200,315,125,350,100,380,64,360,64,330,2
4,250,32,240,24,216,32,200,48,200,64,180
57DATA70,160,85,160,100,165,150,145,1
65,170,180,155,210,185,205,210,240,240,2
65,235,300,255,305,280,325,290,350,270,3
70,270,425,290,445,275,445,245,480,195,5
05,190,510,170,525,145,545,145,550,125,5
42,100,550,100,575,125,560,145
58DATA570,160,585,155,590,145,608,150
,600,170,550,190,558,200,516,220,516,245
,490,275,495,310,510,310,510,290,526,290
,550,250,625,200,635,145,660,108,700,92,
692,84,650,100,680,50,695,50,695,80,716,
80,724,92,692,108,700,124,684,160
59DATA708,140,724,156,708,172,772,180
,750,124,770,80,840,40,860,50,860,70,916
,50,960,80,980,70,990,0
60DATA0,0,290,740,260,675,275,680,275
,670,260,640,280,640,275,625,290,615,270
,595,255,600,240,590,250,585,240,575,225
,575,220,565,240,560,240,545,200,530,235
,515,240,525,290,505,315,505,325,515,310
,530,340,530,340,550,325,560,325,610
61DATA310,620,300,660,340,700,305,710
,325,735,290,740,0,0,225,670,200,635,175
,655,150,635,175,625,150,610,140,600,155
,585,208,595,245,645,225,670,0,0,2,100,6
5,150,80,145,75,130,125,115,130,100,180,
115,230,120,320,95,340,105,365,80,408
62DATA100,425,80,440,80,416,60,450,0,
0,0,240,184,240,176,250,184,0,0,265,200,
265,190,280,190,280,205,265,200,0,0,290,
215,296,205,304,215,290,215,0,0,408,240,
400,216,432,232,424,248,408,240,0,0,380,
```



```
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500,100,490,110,470,110,0,0,710,25,700,1
0,725,2,765,16,710,25,0,0,900,25,900,10,
940,10,955,40,900,25,0,0,160,950,150,925
,180,900,250,910,280,950,0,0
   64DATA800,185,999,210,0,0,999,290,940
,305,900,275,890,320,840,330,795,210,800
,180,1,1
   65DATA0,0,65,330,105,320,40,200,0,0,2
10,320,300,260,0,0,230,630,212,652,232,6
60,0,0,688,250,640,320,0,0,504,450,512,5
52,0,0
   66DATA280,640,300,650,0,0,270,590,240
,550,0,0,535,675,620,920,680,950,710,880
,0,0,740,950,808,780,755,730,0,0,340,500
,430,425,390,350,390,280,0,0,370,505,400
,500,440
   67DATA550,0,0,400,495,400,475,385,460
,400,475,410,455,400,445,0,0,410,390,450
,375,500,375,525,400,510,450,550,465,550
,540,550,465,690,405,710,430,700,550,635
,550,0,0,690,405,680,390,692,375,775,375
,800,290,825,280,0,0,812,250,692,248,0
   68DATA0,635,320,690,370,635,320,590,3
15,565,345,595,375,565,345,520,335,510,3
15,520,335,490,360,450,360,0,0,795,210,7
70,195,760,175,770,195,690,204,690,250,6
90,180,625,150,650,165,635,220,620,200,0
,0,980,70,999,70,0,0,375,90,390,0,0,0
   69DATA150,100,150,0,0,0,450,375,450,3
50,390,350,0,0,525,400,580,400,610,365,6
80,390,1,1
   70DATA4,145,70,100,112,180,108,116,23
0,76,100,344,80,96,404,68,96,508,96,110,
490,4,20,720,12,36,936,4,210,996,52,80,9
20,44,80,844,50,90,685,90,96,660,80,104,
704,104,635,676,140,160,708,280,335,904,
290,310,996,620,950,800,710,730,700
   71DATA170,185,790,605,885,584,585,620
,552,675,704,468,545,560,615,540,630,480
,630,650,496,465,490,260,460,475,220,165
,375,95,200,204,35,160,164,80,145,165,15
0,155,175,180,270,295,360,236,248,260,19
5,295,485,145,195,540,145,164,590,108
   72DATA150,556,100,112,548,220,236,408
,236,244,424,144,170,392,170,192,410,208
,215,295,190,200,270,510,740,292,515,530
,232,590,600,255,652,664,220,588,652,180
,900,950,192,584,588,160,0,0,0
   73DATAFRANCE,325,375
   74DATARUSSIA,850,600
   75DATAITALY,475,240
   76DATASPAIN,150,250
   77DATAENGLAND,290,560
   78DATAEIRE,184,625
   79DATANORWAY,510,775
   80DATAPOLAND,630,480
   81DATAGREECE,664,130
   82DATASCOTLAND,284,700
   83DATAICELAND,200,944
   84DATASWEDEN,560,690
   85DATAFINLAND,712,800
   86DATANORTHERNIRELAND,216,664
   87DATAWALES,232,584
   88DATAEAST     GERMANY,512,512
   89DATAWEST     GERMANY,444,480
   90DATAHOLLAND,380,536
   91DATABELGIUM,364,496
   92DATALUXEM-   BOURG,380,468
   93DATAPORTUGAL,48,288
   94DATACZECHO-  SLOVAKIA,560,432
   95DATASWITZER-LAND,410,376
   96DATAAUSTRIA,528,384
   97DATARUMANIA,728,332
   98DATAYUGO-    SLAVIA,600,272
   99DATAALBANIA,624,196
  100DATABULGARIA,728,228
  101DATAANDORRA,244,296
  102DATATURKEY,888,132
  103DATATUNISIA,400,40
  104DATAALGERIA,250,56
  105DATAMOROCCO,68,56
  106DATAMAJORCA,260,208
  107DATACORSICA,400,244
  108DATASARDINIA,392,180
  109DATACRETE,720,32
  110DATACYPRUS,912,32
  111DATASICILY,480,100
  112DATASYRIA,976,48
>
```

A little bit of magic from and the BBC

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MERLIN SCRIBE

Scribe is a screen-oriented, integrated word processing system specifically designed for non-technical personnel. Text and command functions are fully prompted.

The program comes in a chip with five minute fitting instructions, a 5¼" floppy disc containing the printer driver and a comprehensive instruction manual.

Model features include:

Automatic disc buffering

The text is moved between disc and computer memory without user intervention. Thus, file (document) size is limited only by disc capacity (up to a maximum of 255 pages).

Status line

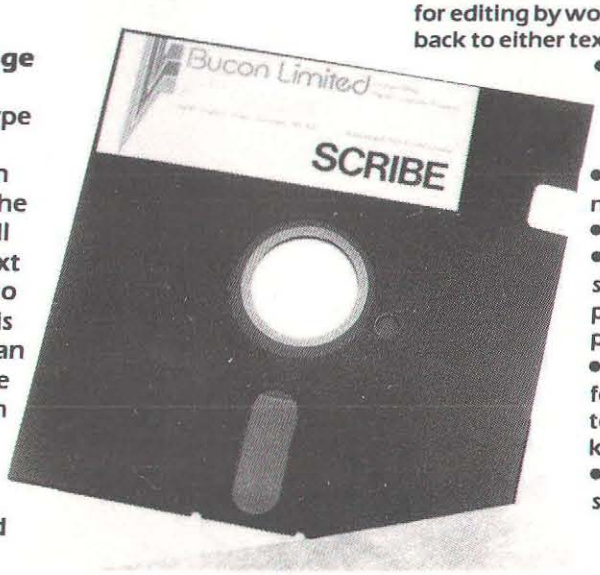
The status line displays the name of the file being edited, the page, line number and column at which the cursor is located, and command(s), if any, in current operation.

Directory display

The disc file directory can be displayed as required by the user.

On-screen printer-image text formatting

The effect of margin type (either right-justified or ragged right) and margin settings is displayed on the screen just as the text will appear on paper. 'The text is automatically formed to the current settings as it is entered. Either setting can be later changed, and the result "previewed". Both settings can be mixed within a document. Selective margination permits "cutting" around an illustration.



Word-Wrap

This eliminates the need to enter a carriage return at the end of each line. A word too long to fit at the end of a line is automatically moved to the next line. RETURN is used only to indicate the end of a paragraph or to create a line space. This eliminates many keystrokes and increases the rate of text entry.

Other Major Facilities are:

- Create up to 255 pages in a single document.
- Screen user selectable 40 or 80 column with choice of background and text colours.
- Insert text at any page on the document whether currently in memory or not.
- Powerful editing commands:
Move, copy and delete with affected text displayed in reverse video. Will move or copy within a page or to any other page in the document.
- Word search and replace — item by item or globally throughout the document.
- "Go to page" — next and previous using up and down cursor keys or go directly to page numbers
- On screen underlining.
- Format line controls document width and allows setting of right and left margins.
- Tabs set on format line as required.
- Automatic centre and decimal tab.
- Text reformatting.
- Split page and dynamic page break display.
- Word count and display of cursor position by column & li number.
- Will use disc surfaces 0 to 3 as allowed by the BBC system.
- All disc filing operations menu driven, eg. re-name, copy delete document, compact and catalogue disc, etc. No knowledge of the disc system required.
- Exec document — allows conversion of BASIC programs for editing by word processor and then re-conversion back to either text or program files.
- File merge — one or more documents o other text files may be merged in sequence from any disc drive between and 3.
- Automatic page numbering with page number insertion at any point on the page.
- Headers and footers.
- Total facility print module including selection of serial or parallel output, global printer control codes, page numbering offs print from page to page, repeat print, etc.
- Selection of up to nine user definable ke for insertion of printer control codes into text, with up to five codes allocated to each key.
- Control number of page display lines fo scroll speed increase.

The program comes attractively packaged in a simulated leather grain wallet which contains the manual, disc, chip & function key legend strip.

a magical

ERLIN COMPUTER PRODUCTS

licrocomputer...

nt manufacturer of software and add ons.
ring professional standards to personal computers.

MERLIN DATABASE

COMING SOON

Merlin Database is a database system designed exclusively for the BBC disc based computer. It provides for the structural input of text and numerical data which is stored permanently as a record on the computer. A group of records constitutes a database. Any number of databases may be created using Merlin Database.

Once created there are sophisticated facilities available for searching, selecting and drawing off information from the database by means of defining the search characteristics. This information can then be formatted for producing printed reports, lists etc.

Numerical information may have arithmetic calculations applied to it which includes accumulation of totals, multiplication, division etc. etc.

In conjunction with Merlin Scribe, Merlin Database provides a superb mail merge facility. In addtion Scribe can be used as a high powered formatter to construct the report layout of information drawn from the database.

Performance

- Maximum records per database 4000 • Maximum record size 1800 characters • Maximum no. of fields 32
- Maximum no. of characters for any single field 900
- Find any record in 2 seconds via key field access
- Search every character in a 100 kb database in 29 secs

Field Types

- Numeric — up to 9 digits • Date
- Sub fields for economic disc usage i.e. specify average & maximum field size

Data Search

- Search results directory held with database on disc
- Data can be passed to mail merge and report writer
- 16 level conditional search
- Search conditions include 'not', >, <, = .
- Wild card
- Database automatically sorted by key field
- Databasse can be set to re-sort to any alternative set of key fields

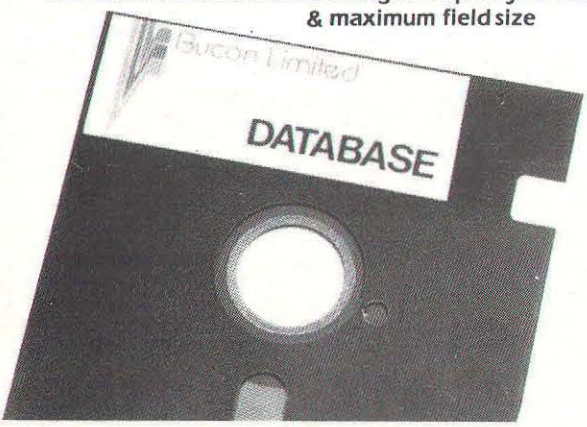
Report Writing

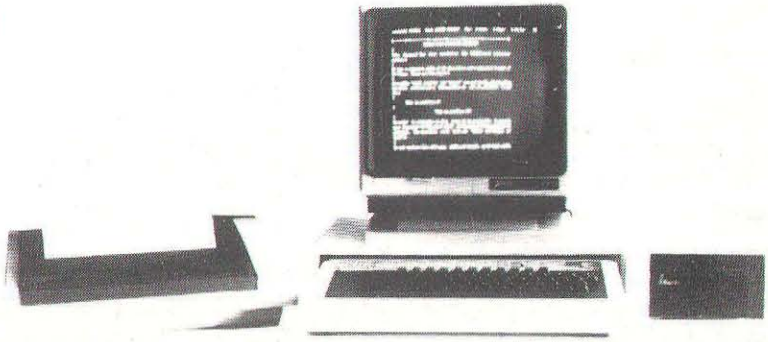
- Database will integrate with Merlin Scribe word processor
- Format printer output with simple forms editor
- High powered forms layout & editing using Scribe (alls. rt. justify)
- Arithmetic calculations & accumulators
- Conditional report writing
- Semi programming facility for forms & report generation

Other Facilities

• Mail merge using Scribe • Conditional mail merge • Automatic reformating of lines • Capable of conditional transfer of information between databases.

Database comes in chip with manual, simple fitting instructions & systems disc. Also planned is the production of Database integrated with the Merlin Scribe word processor in a single chip although the database is designed to integrate easily with Scribe in a separate chip.





Prices:
MERLIN DATABASE £49.00
MERLIN SCRIBE £59.95
MERLIN SCRIBE/DATABASE £95.00

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mbination.

Advanced Graphics

Bruce Smith

Our genie of the graphics lamp codes some further on screen illusions.

Last time we examined the way in which image planes could be constructed so that objects can be displayed on the screen background, midground or foreground. This time we'll look at the way in which we can examine and define characters in readiness for animation!

As we have seen (March/April issue) the screen memory maps of the Beeb and Elk are configured in a rather unusual way. To recap slightly, bytes do not run across the screen in sequence, but across and down the screen in 'blocks of eight' as Figure 1 illustrates (I include this here as it was 'missing' from the issue of ***A&B*** in question!).

HIMEM	HIMEM+8	HIMEM+16
HIMEM+1	HIMEM+9	HIMEM+17
HIMEM+2	HIMEM+10	
HIMEM+3	HIMEM+11	
HIMEM+4	HIMEM+12	
HIMEM+5	HIMEM+13	
HIMEM+6	HIMEM+14	
HIMEM+7	HIMEM+15	

Fig 1 Typical organisation of screen memory

Therefore the byte at HIMEM + 8 is directly adjacent to the byte situated at HIMEM. This at first sight may seem to be a rather odd way to 'map' screen memory, however consider the complexities involved in even mundane tasks such as printing text if it were not so. Characters are defined using a byte wide by eight byte deep grid. To display a character in *any* mode (except the Beeb's Teletext Mode 7) all the operating system has to do is to locate the characters eight bytes and poke them into consecutive memory locations.

CHARACTER TABLE

The information for each ASCII character is stored permanently within ROM starting at location &C000. As there are 95 printable characters the Character table is 950 bytes long (95 characters * 8 bytes per character). The table commences with the bit pattern or bit map for the " " character (ASCII 32) and ends with the bit map for the pound sign. "£" (ASCII 126).

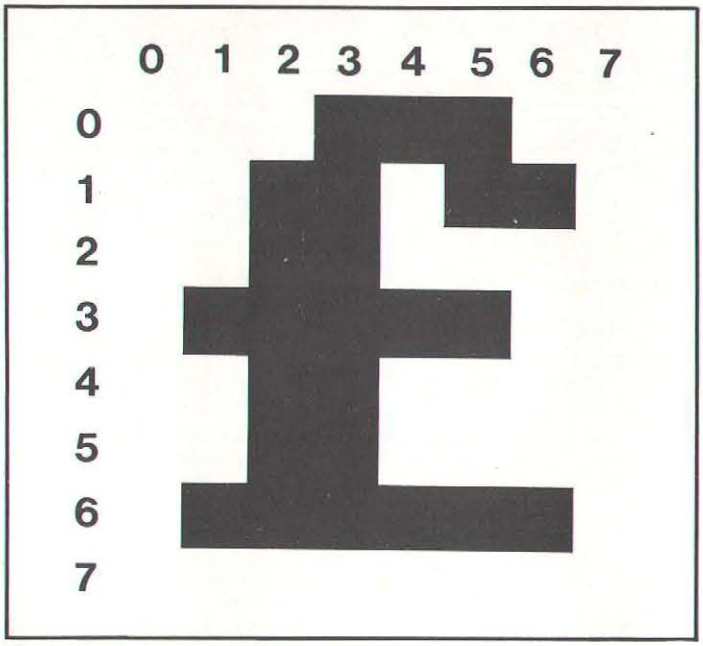

Fig 2 A typical output of Program 2

To access the correct bytes for a particular character the MOS subtracts 32 from the characters ASCII code, multiplies this value by 8, adding the product to &C000. Listing 1 provides a simple program that will display the bit map in hex and decimal formats for any of the alphanumeric characters. It first requests you to enter the character at the keyboard from which it calculates its bit map position in ROM (line 140 to 200). The two loops embodied between lines 240 to 340 peek and display the eight byte values.

UNLAWFUL

The above program suffers from a couple of major drawbacks. Firstly it is utterly illegal! Well I don't suppose I'm about to be put under lock and key, but if future Machine Operating Systems are ever released then chances are this character table will be shuffled about in memory, making the program useless. Secondly this method will only display alphanumeric ASCII codes as these are the only ones stored in ROM, it cannot display RAM based User Definable Characters.

We can get round both these problems by using the official process of reading character definitions, namely an OSWORD call with the Accumulator containing &OA. As with all OSWORD calls the MOS expects the two index registers to hold the address, high byte in Y, of a parameter block. In this instance the parameter block is 9 bytes in length and Table 1 shows its organisation. The first location in the parameter block should be loaded with the ASCII code of the character to be read, obviously this must be placed here 'before' the OSWORD call. On return the following eight bytes hold the characters bit map.

Listing 2 will read the definition of any ASCII character and then display it graphically on an 8 *8 matrix. The program commences by setting up the screen and constants. The VDU command (line 130) defined ASCII code 255 as a white block, this is used to indicate a set bit while a space is used if a bit is clear. A simple grid is printed by PROC_GRID and you are then requested to enter the ASCII code of the character to be read. PROC_read_definition (lines 340 to 400) perform the appropriate OSWORD call. As we are using BASIC the integer variables, A%, X%, and Y% are used to pass information to the processor registers. The parameter block address is held in the variable PARAM. This was set to &70 at the beginning of the program, so the intention is to use several of the 'free' zero page locations. The high and low bytes of the address are derived using the DIV and MOD functions (lines 360 and 370), the characters code is stored at PARAM (line 390) and the OSWORD call performed (line 400).

BIT MAP

The bit map of the character is printed by the procedure PROC_display_definition. An outer loop (line 470) uses the variable C% to read each eight bytes in turn from the parameter block. The inner loop (line 530) calculates which bits are set or

Table 1: Osword Parameter Block Organisation

XY	:	Character to be read
XY+1	:	Top byte of character definition
XY+2	:	Second byte of character definition
XY+3	:	Third byte of character definition
XY+4	:	Fourth byte of character definition
XY+5	:	Fifth byte of character definition
XY+6	:	Sixth byte of character definition
XY+7	:	Seventh byte of character definition
XY+8	:	Eighth byte of character definition

N_2O_3

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nodest: f > →

beeld kleiner

goed sg: 0,999 → 9

kont on 1,111 → 98,8

2,71828...

2,718281828

3,14159265~~4~~

in between days

kyoto song

the blood

six different days

push

the baby screams

close to me

A night like this

screw

sinking

close to me (12h)

AZLEC

CAMERA

(met all I need is

everything! & still

on fire!)

PRINSENGRACHT 733 AMSTERDAM 020-242274

PRINSENGRACHT 733 AMSTERDAM

PRINSENGRACHT 733 AMSTERDAM

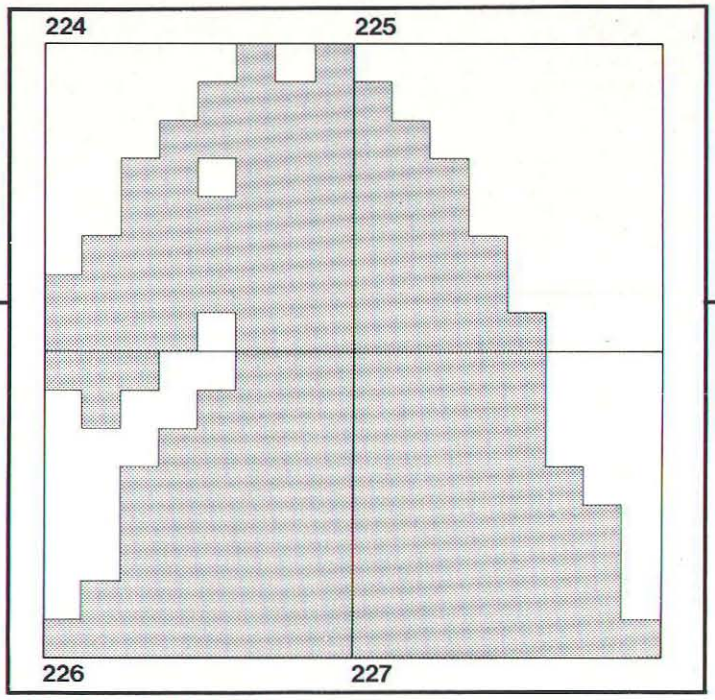


Fig 3 A knight chess piece

clear (line 540), printing a 'block' if a bit is set or a space if a bit is clear. This inner loop is repeated 8 times until the complete bit map is printed. Figure 2 shows the output for ASCII code 96, you might recognise it!

COLOURFUL CHARACTERS

Before moving on to character defining, it is worth examining how characters are printed in colour. In a normal two colour mode, (ie Black and White) a character is displayed on the screen by the MOS simply by poking each byte into successive memory locations. This is not so straightforward though when a four colour mode is in use. In this instance the MOS must calculate the two eight bit values for each of the eight bytes to PRINT in the correct colour. In Mode 2 sixteen colours are available for use so the MOS must convert each byte into four eight bit values before PRINTing the character (see March/April issue for pixel descriptions for each Mode). We shall examine this more closely in a future issue to develop a program that will allow multi-colour character printing!

Table 2: Memory Allocation for Exploded Character Set

*FX20,0	&80 to &9F	&C00 to &CFF
*FX20,1	&A0 to &BF	as above plus OSHWM + &FF
*FX20,2	&C0 to &DF	as *FX20,0 plus OSHWM + &1FF
*FX20,3	&E0 to &FF	as *FX20,0 plus OSHWM + &2FF
*FX20,4	&20 to &3F	as *FX20,0 plus OSHWM + &3FF
*FX20,5	&40 to &5F	as *FX20,0 plus OSHWM + &4FF
*FX20,6	&60 to &7F	as *FX20,0 plus OSHWM + &5FF

VDU 23

The VDU 23 command allows you to define your own characters. These User Definable Character definitions are stored in RAM between &C00 to &CFF. In the default state up to 32 User definitions may be implemented assigning the ASCII codes 128 to 159. Chapter 29 of the User Guide provides details on implementing the VDU 23 command.

If more definable characters are required then extra memory must be reserved for them by a technique known as 'Exploding the character RAM'. To do this an *FX20 call must be performed. Table 2 details the memory allocations required for each explosion step of 32 characters. The MOS allocates this extra memory directly above OSHWM (Operating Sytem High Water Mark), which is normally the value assigned to PAGE.

In its unexploded state, ASCII characters greater than the 'permitted' 128 to 159 may be used, but a wrap around effect occurs. Thus printing VDU 255 would be the same as printing VDU 159.

Listing 3 is a Character designing program. This operates along similar lines to the character Reader Program except that you set and clear each bits as required by pressing either the 1 or 0 key respectively (lines 300 to 340). As each line is completed its byte value is calculated and displayed. On completion you are requested to enter the ASCII code into which the definition is to be placed (line 410), upon which the entire definition is printed along with the actual size character (line 560 to 650).

As an example, enter and RUN the program, then key in the following sequence of 1's and 0's to design a Castle from a game of Chess,

01010100
01111100
00111000
00111000
00111000
00111000
01111100
11111110

You might like to undertake expanding the program so that it can handle grids of characters. For example using four characters it would be possible to design and display the Knight shown in Figure 3. To display it, all we need to do is to print the ASCII codes containing the definition as a four byte block as illustrated in Listing 4.

NOW YOU SEE ME, NOW YOU DON'T

We can use a user definable character to illustrate that the image planes we constructed last time do actually exist, the idea being to move an object across the screen so that it passes in front of objects in the background and midground but behind objects in the foreground. Listing 5 performs just this, it moves a horse (okay a knight chess piece!) across a 16 colour Mode 2 screen, passing in front of a cyan coloured square and then behind a yellow coloured square.

It's worth examining the programming techniques. The program commences by selecting a Mode 2 screen with a blue background (lines 60 and 70), the chess horse is then defined (lines 100 to 130). Line 190 is interesting, it shows how the four ASCII codes can be incorporated into a single string for printing purposes. The first two codes are followed by three VDU control codes. CHRS$(10) moves the cursor down one line, while the two CHR$(8)s are backspaces, positioning the cursor ready to print the rest of the definition! Note that a special formatting technique has been used to list this line, when you enter it just type it in as a single line.

Lines 210 to 260 overlay a green midground using the GCOL0,2 command. Two squares are then drawn (lines 280 to 420) in yellow and cyan. In both cases the palette has been redefined so that logical blue is physical yellow (line 300) and logical red become physical cyan). The appropriate GCOLs have been used to ensure that these colours are 'painted' over both the midground green and background blue.

DEFINITIVE

The palette now has to be set so that the Knight will appear the same 'colour' no matter where it is positioned on the screen. Lines 450 to 470 take care of this to produce a black knight. Logical colours flashing red-cyan, flashing green-magenta and flashing blue-yellow are defined as physical black, black and yellow respectively. The GCOL 3,8 statement now ensures that the knight will always be visable on the screen except when it is overlayed on a yellow background. The final lines (520 to 590) PRINT the knight at the position of the graphics cursor which is moved across the screen in steps of 2 each time a key is pressed, first 'behind' the yellow square which is in the foreground, and then in front of the cyan square which is in the midground. Refer to the March/April issue and see if you can work out at bit level just what is happening.

CONTINUED OVER

PROGRAM LISTING 1

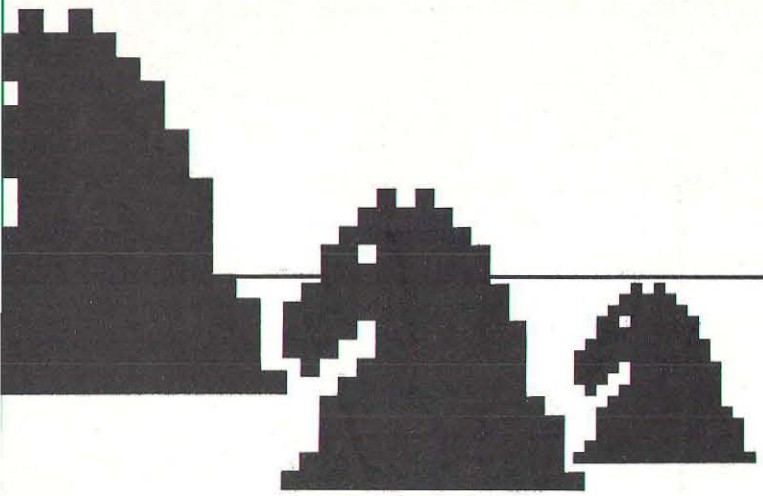
```
 10 REM *** Read ROM based Character ***
 20 REM *** definition table.  Table ***
 30 REM *** based in MOS from &C000  ***
 40 REM *** Bruce Smith  March 1984  ***
 50 REM *** A & B Computing          ***
 60 :
 70 @%=0
 80 TABLE=&C000
 90 MODE 6
100 VDU 19,0,4,0;0;0;
110 :
120 PRINTSPC(4);"ROM Character table reader"
130 PRINTTAB(0,4);
140 PRINT"Type character to be examined : ";
150 A$=GET$
160 PRINTA$
170 :
180 A%=ASC(LEFT$(A$,1))
190 BASE%=(A%-32)*8
200 START%=TABLE+BASE%
210 :
220 PRINTTAB(0,7);"Character data for ";A$;" is :"'
230 :
240 PRINT"HEX:"
250 FOR LOOP%=0 TO 7
260 PRINT "&";~LOOP%?START%;
270 PRINT",";
280 NEXT
290 :
300 PRINT''"DECIMAL:"
310 FOR LOOP%=0 TO 7
320 PRINT LOOP%?START%;
330 PRINT",";
340 NEXT
```

PROGRAM LISTING 2

```
 10 REM *** Character Definition Reader ***
 20 REM *** BBC Micro and Electron      ***
 30 REM *** Bruce Smith                 ***
 40 REM *** A & B Computing             ***
 50 @%=0
 60 OSWORD=&FFF1
 70 PARAM=&70
 80 :
 90 REM set up screen
100 :
110 MODE 6
120 VDU 19,0,4,0;0;0;
130 VDU 23,255,255,255,255,255,255,255,255,255
140 PRINT SPC(6);"Definition Reader"
150 PRINT'
160 :
170 PROC_GRID
180 PRINTTAB(0,15);
190 PRINT"ASCII code to be examined : ";
200 INPUT asc%
210 PROC_read_definition
220 PROC_display_definition
230 END
240 :
250 REM Procedures
260 :
270 DEF PROC_GRID
280 PRINT" ";
290 FOR N%=0 TO 7:PRINT N%;:NEXT
300 PRINT
310 FOR N%=0 TO 7:PRINT N%:NEXT
320 ENDPROC
330 :
340 DEF PROC_read_definition
350 A%=&A
360 X%=PARAM MOD 256
370 Y%=PARAM DIV 256
380 ?PARAM=asc%
390 CALL OSWORD
400 ENDPROC
410 :
420 DEF PROC_display_definition
430 PRINTTAB(1,4);
440 :
450 REM outer loop step bytes
460 :
470 FOR C%=1 TO 8
480 BYTE%=PARAM?C%
490 VAR%=128
500 :
510 REM inner loop step bits
520 :
530 FOR N%=0 TO 7
540 Z%=BYTE% AND VAR%
550 IF Z%=VAR% THEN PRINTCHR$(255);ELSE PRINTCHR$(32);
560 VAR%=VAR%/2
570 NEXT
580 PRINT TAB(1,(4+C%));
590 NEXT
600 ENDPROC
```

PROGRAM LISTING 3

```
 10 REM*** Character Designer    ***
 20 REM*** for BBC and Electron ***
 30 REM***     Bruce Smith       ***
 40 REM***    A & B Computing    ***
 50 :
 60 DIM array% 8
 70 VDU23,255,255,255,255,255,255,255,255,25
 80 @%=0
 90 REM set up screen & display grid
100 MODE 6
110 VDU19,0,4,0;0;0;
120 PRINTSPC(6);"Character Designer"'
130 PRINT" Press 0 to clear the bit"
140 PRINT" Press 1 to set the bit"
150 PRINT
160 PRINT" ";
170 FOR N%=0 TO 7:PRINT N%;:NEXT
180 PRINT
190 :
200 FOR N%=0 TO 7:PRINT N%:NEXT
210 :
220 REM set up main two loops
230 :
240 FOR M%=1 TO 8
250 BYTE%=0 : CNT%=128
260 FOR N%=1 TO 8
270 PRINT TAB(N%,M%+5);
280 :
290 REPEAT
300 KEY%=GET
310 UNTIL KEY%=ASC"1" OR KEY%=ASC"0"
```



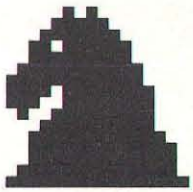
```
320 :
330 IF KEY%=ASC"1" THEN PROC_SET
340 IF KEY%=ASC"0" THEN PROC_CLEAR
350 :
360 NEXT
370 PRINT"    ";BYTE%;
380 array%?M%=BYTE%
390 NEXT
400 PRINTTAB(0,14)
410 INPUT"Which ASCII character " chr%'
420 PROC_display_vdu
430 END
440 :
450 DEF PROC_SET
460 PRINTCHR$255;
470 BYTE%=BYTE%+CNT%
480 CNT%=CNT%/2
490 ENDPROC
500 :
510 DEF PROC_CLEAR
520 PRINTCHR$32;
530 CNT%=CNT%/2
540 ENDPROC
550 :
560 DEF PROC_display_vdu
570 PRINT"Definition follows :"'
580 PRINT"VDU 23,";chr%;",";
590 FOR M%=1 TO 8
600 PRINT array%?M%;",";:NEXT
610 PRINT
620 PRINT'"The character is : ";
630 VDU23,chr%,array%?1,array%?2,array%?3,
    array%?4,array%?5,array%?6,array%?7,
    array%?8
640 PRINTCHR$(chr%)
650 ENDPROC
```

PROGRAM LISTING 4

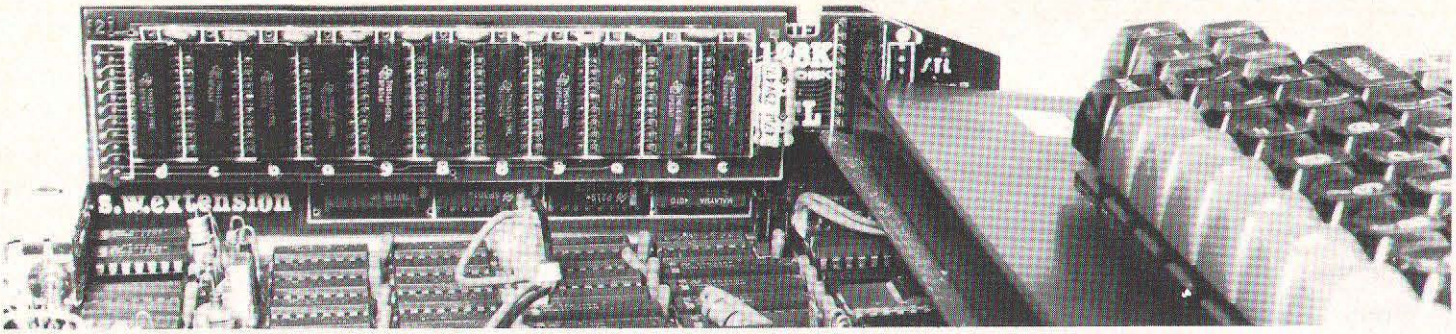
```
10 REM *** Knight Chess piece ***
20 MODE 4
30 VDU23,224,5,7,15,31,55,63,127,243
40 VDU23,225,0,0,128,128,128,192,192,224
50 VDU23,226,247,231,111,15,31,31,63,127
60 VDU23,227,224,240,240,248,248,252,252,254
70 PRINT CHR$(224);CHR$(225)
80 PRINT CHR$(226);CHR$(227)
90 PRINT
```

PROGRAM LISTING

```
 10 REM *** Moving in front of and ***
 20 REM *** behind objects         ***
 30 REM *** Bruce Smith            ***
 40 REM *** A & B Computing        ***
 50 :
 60 MODE2
 70 VDU 19,0,4,0;0;0; : REM blue screen
 80 :
 90 REM define the chess piece
100 VDU23,224,5,7,15,31,55,63,127,243
110 VDU23,225,0,0,128,128,128,192,192,224
120 VDU23,226,247,231,111,15,31,31,63,127
130 VDU23,227,224,240,240,248,248,252,252,254
140 :
150 REM incorporate all characters into
160 REM a single string including the
170 REM control characters
180 :
190 KNIGHT$=CHR$(224)+CHR$(225)+CHR$(10)
    +CHR$(8)+CHR$(8)+CHR$(226)+CHR$(227)
200 :
210 REM draw some midground in green
220 GCOL0,2
230 MOVE0,0
240 MOVE1280,0
250 PLOT 85,0,500
260 PLOT 85,1280,500
270 :
280 REM draw a yellow square
290 GCOL0,4
300 VDU19,4,3;0;
310 MOVE 300,300
320 MOVE 500,300
330 PLOT 85,300,600
340 PLOT 85,500,600
350 :
360 REM draw a cyan square
370 GCOL0,1
380 VDU19,1,6;0;
390 MOVE 700,300
400 MOVE 900,300
410 PLOT 85,700,800
420 PLOT 85,900,800
430 :
440 REM set colours for knight
450 VDU19,10,0;0;
460 VDU19,9,0;0;
470 VDU19,12,3;0;
480 :
490 VDU5 : REM join text & graphic cursors
500 GCOL 3,8
510 :
520 REM animate the knight
530 FOR LOOP%=290 TO 0 STEP -2
540 MOVE LOOP%*4,350
550 PRINT KNIGHT$
560 KEY=GET
570 MOVE LOOP%*4,350
580 PRINT KNIGHT$
590 NEXT
```



SOLIDISK SIDEWAYS RAM: 8,000 UNITS SOLD



"Exciting" (ACORN USER JAN 84), **"Power to your Beeb"** (PCN 61, MAY 84)

HOW ABOUT COMPATIBILITY?
The Sideways RAM is completely compatible with all issues of BBC computers, disks, all sideways ROMs, second processor, Torch disk pack, Teletext, Econet etc. but NOT with ROM extension boards, since it can replace them.

Its power consumption is so low that you can use it in conjunction with twin disks.

HOW DOES IT WORK?
Occupying the same place as sideways ROMs (such as BASIC, DFS, CPN etc), it is treated like other Sideways ROMs and therefore can replace them.
The Machine Operating System uses Sideways RAMs as naturally as Basic, without procedures or programming rules.
Sideways RAM can run any language, any filing system including Hi-Basic and second processor DFS.

SIDEWAYS RAM POWER IS IN THE SOFTWARE:
Different from Sideways ROMs, Sideways RAM can be written into. This property gives birth to a NEW GENERATION of software for the BBC computer: SERVICE RAMs and VIRTUAL MEMORY PROCESSOR.
Each SERVICE RAM has its own commands and code as its counterpart Sideways ROM but has its own private workspace and storage area thus leaving you with the lowest possible PAGE value (PAGE = &E00). On the other hand, the Virtual Memory Processor can run huge MACRO BASIC programs (Megabytes are not the limit), keep them on disk and uses the basic 32k of RAM as transient program area. All software for the Sideways RAM system is free.

FREE SOFTWARE?
Solidisk Sideways RAMs is bundled with lots and lots of software, FREE and we mean FREE, now and later. It is quite simple: for every Sideways RAM sold, £1 is spent on MORE software. Sideways RAM users are invited to spot new applications and contributions are rewarded at the usual rate of £1 for every 4 bytes of machine code.
The result is printed on the opposite page.

HOW ABOUT THE FUTURE?
Solidisk Sideways RAM is also widely used in schools for ECONET stations, by professional programmers for writing programs, research laboratories for RAM disk data base, at home for wordprocessing and now even games.
New areas are being developed: Telesoft and Teletext logging, Speech Processor assembler and Relational Data base to cite a few.
As the price of 16k EPROMs are as high as £20 at the present time, more Sideways ROM software publishers will be willing to sell their software on disk. Solidisk will mail FREE OF ANY COST their advertisement to ALL Sideways RAM users providing the price of the Disk version reflects savings in the cost of the ROMs. Solidisk believes that the majority of BBC users will have their Sideways RAM fitted before the end of next year.
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Remove the keyboard from the BBC computer and instal it in the new case. Replace the old 3" keyboard tail by the new 24" cable and you can work really in comfort even for very long hours. The keyboard case is more a productivity tool than just ergonomics.

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Replace the top of the BBC computer case by this metal CPU case. Sit your monitor on top (it is tough enough to take even your weight!). The CPU case has 2 compartments for half height 5.25" disk drives with fixing screws, air vents and provision for a bolt-on fan. At first sight, there is no trailing wire. Looking inside, there is enough room to accomodate Teletext Adapter, Second Processor, Solidisk and a fan!

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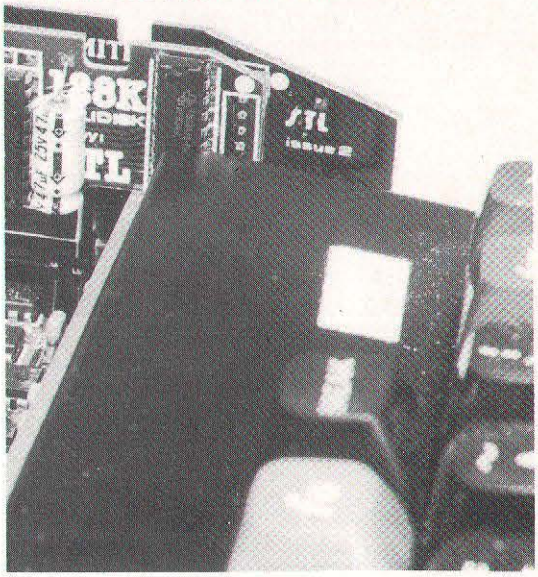
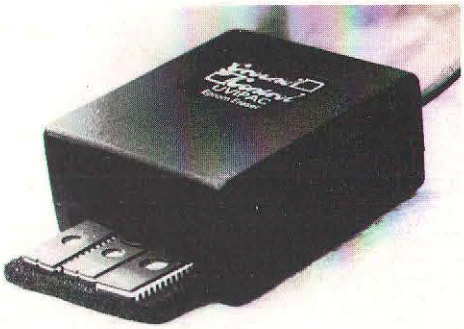
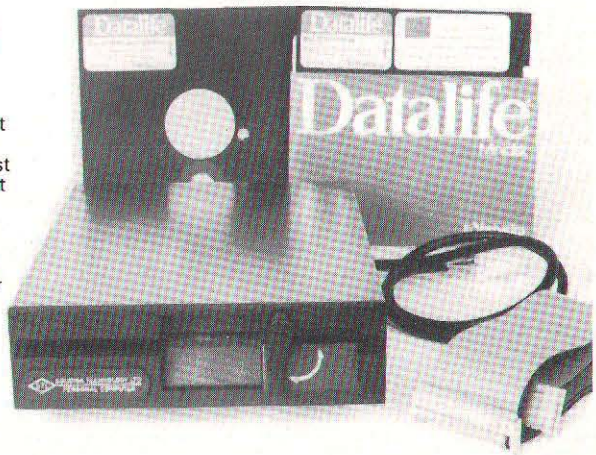


UVIPAC EPROM ERASER



TEAC DISC DRIVES FD55 Series



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Solidisk Sideways RAM is available in 16l (SWR16), equivalent to 1 sideways ROM, 32k (SWR32), equivalent to 2 sideways ROMs, 128k (Solidisk), equivalent to 8 sideways ROMs and the 208k Solidisk equivalent to 12 Sideways ROMs. You can buy a small Sideways RAM now and upgrade it later. From the SWR16 to the SWR32 is by straight exchange, from the SWR32 to the Solidisk is by adding the 96k Solidisk Extension, from 128k to 208k is by exchange of the RAM card.

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WORD64:
WORD 64 is a Service RAM, it uses Solidisk as storage for WORDWISE, up to 64K free characters for any text.

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PRINTER BUFFER is a Service RAM, it increases 500 times the normal 32 bytes printer queue to 15K bytes, completely transparent to the user. PRINTER BUFFER is as useful for printing a long document as for a short program listing.

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STLOO is a Service RAM, it is Disk Filing System that leaves PAGE at &EOO, has built-in disk formatter/verifier and automatic track stepping for 40/80 track disk drives.

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STL150 is a Service RAM to enhance Acorn's .90 DFS to offer up to 150 directory entries per side.

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MACRO-BASIC is a program generator. You use a wordprocessor to create a command file which is then scanned by MACRO. MACRO uses other programs, subroutine libraries, text files (actually any or all files on your disks) as source to generate a bug free BASIC program which can be very large (Megabytes are not the limit).

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VIRTUAL MEMORY PROCESSOR (VMP) uses extensively overlay technique and Solidisk as back store for very large programs that cannot be run otherwise. VMP uses the 32k basic RAM as transient area: it operates on a Main Program as generated by MACRO-BASIC, taking different segments from the Solidisk Store, POOL, HOLD, FREE or CLEAR segments from the transient area. For example: VMP will accept 20 segments of 10k of Basic assembler and assembles it into 16k of machine code.

MENU:
MENU puts all computer's resources at your fingertips. MENU displays your Sideways Firmare, Disk Directories, Sideways RAM system, Solidisk System etc.

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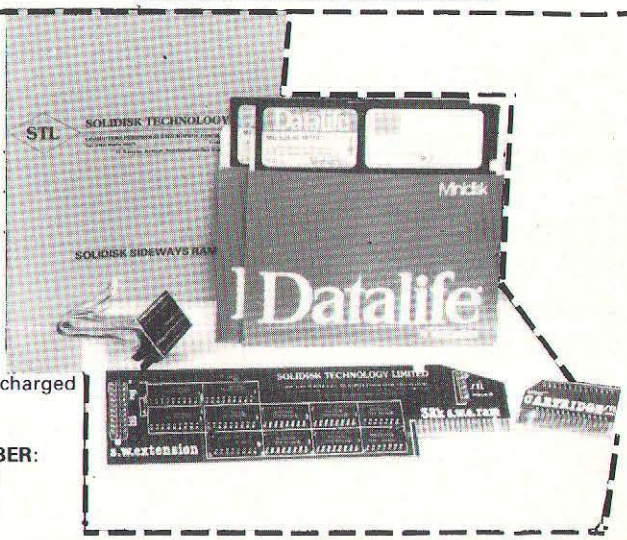

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Software Reviews

Title	**Star Trader**
Type:	**Tape**
Publisher	**Tape**
Machine	**First Byte Software**
Price	**£7.95**

This game puts you in charge of a large space freighter; your mission is to find the Super Computer and bring it back to the Solar System. However the computer must be bought for a large sum of rare metals; this makes it necessary to first explore the five nearby star systems, leaving robot mining colonies on planets rich in minerals and gemstones. It is also important to keep your supplies of food, water, air and fuel topped up. Hostile aliens may attack you, so it is important not to aggravate them. Friendly or neutral inhabitants may be subjugated or made members of the Empire.

Controls are very simple; just the cursor keys and a few others. The game has one of the best sets of built in instructions I have seen, and a save game facility is also provided-games take a long time.

Although well written and thought-out, it is very monotonous; you always seem to be doing the same things. A winning technique is easily mastered, and once the computer is taken to the solar system, there is no point in playing the game again in my view, except possibly to improve your score.

Overall, I would say that this is a well programmed game, which falls flat on its face because it has little or no lasting appeal.

Ratings Table:

SOUNDS	N/A
GRAPHICS	65%
DOCUMENTATION	80%
VALUE FOR MONEY	50%
OVERALL	55%

Title	**737 Flight Simulator**
Publisher	**Salamander**
Machine	**Model B/Electron**
Price	**£9.95**

When I did my last batch of reviews, I was very impressed with 'Airline', which allowed me to run an airline company. This time I've been able to go one better and actually drive the plane! Well, drive my micro to be exact, but the Adrenalin levels were running high enough because of this super implementation. I was fortunate enough to be able to try out both the BBC and Electron versions, both of which make fine use of the graphics and sound capabilities of the machines.

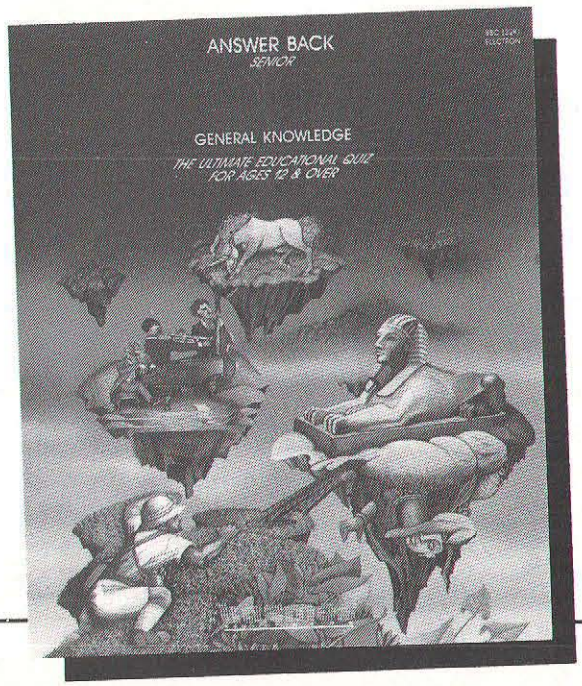
It has to be said at the outset that the BBC version is superior in a few minor details, but that is only to be expected as that machine has considerably better facilities as far as the sound is concerned, and this is a program where sound effects are vital to the overall effect. However, as far as screen display is concerned, the two version are almost identical.

A cockpit view of the runway is shown when the 'take off' option is selected, and a 'dummy run' is written in the superb manual to help to make up for the feeling of panic as the end of the runway approaches. When take off is complete, the screen display above all the dials and switches etc. changes to an aerial view of the airfield and the place. Manoeuvres can be made easily once the controls are familiar, and the reaction times of the key presses are good. An instrument landing system can be used, and I found it invaluable in deciding where to crash! Eventually I decided to practise my landing via that option on the menu, and this concentrated reinforcement at last paid off. I'd written off so many planes before, that the first safe landing was made to loud yells of triumph. The runway display obviously reappears for the landing procedures.

The cockpit controls are extensive, clear and well labelled. It is surprising how quickly one becomes familiar with altimeters, artificial horizons and so on. Colour is employed modestly but to good advantage, and there is a system of warning lights should the speed, altitude or other factor vary beyond allowed limits.

On the sound side, the Electron merely has audible key responses, although these are vital in an emergency. The BBC on the other hand has separate questions for keypresses and engine noise. The latter changed pitch most realistically as power altered, but could become rather wearing after a while. There are also slight differences on the landing lights and on the messages once the plane was down. One option I particularly liked was the Day/Night flight.

I could go on about this program for a long time, so let me just say this: if you have a BBC or an Electron, go out and buy it!



Ratings Table:

SOUNDS	95%
GRAPHICS	90%
DOCUMENTATION	100%
VALUE FOR MONEY	95%
OVERALL	95%

Title	**Answer Back (Senior) Quiz**
Publisher	**Kosmos**
Machine	**Model B/Electron**
Price	**£10.95**

If you like quizzes then this is the one for you. A control program loads various data files with questions and answers on subjects varying from Astronomy to Famous People and Sport. There is also the option to create your own quizzes and so once you have this program you shouldn't need to do anything other than go down the library to look up the relevant facts and figures.

When you have loaded the data file of your choice you are asked to select from multiple choice, yes/no and complete the answer formats. You can plump for all three if you want. You must also select the number of questions, random or sequential selection, and whether you would like to be timed.

The display page now appears: a moon landscape with craters and the background of stars. on the right bottom corner stands a friendly looking robot who proceeds to shoot the questions into the starry sky. It then does a little dance until you enter your answer. This display is great for the Astronomy quiz but it does seem a shame that some appropriate graphics could not be filed with each set of questions. It's fine having a comet flying in celebration across the sky when you have got a question about Haley's comet right, but it is a bit strange when you have just answered on madrigals and cantatas. The questions are well chosen and you feel that you are learning something useful as well as having fun. There are modern questions, questions involving facts and figures, dates and historical characters, a good mix. There is a repeat option on those questions you get wrong. Great, and in theory unlimited, fun.

Ratings Table:

SOUNDS	70%
GRAPHICS	65%
DOCUMENTATION	90%
VALUE FOR MONEY	80%
OVERALL	85%

Title	**JCB Digger**
Publisher	**Acornsoft**
Machine	**Model B**
Price	**£9.95/£11.50**

J.C. Bamford Excavators approached Acornsoft and asked them to develop a game around their well known digger to support their own promotions. Surprisingly perhaps the answer was in the affirmative. JCB Digger is now available for all BBC owners to play.

The Digger is based on an island (there are two in the game) and the landscape is mapped out for us in the documentation Points are gained by shovelling up the various types of landscape as well as picking up the 'Meanies' which inhabit the islands and dumping them in the sea. It has to be the sea, one of the lakes will not do. There are three JCB's per go and an extra one can be gained by amassing enough points.

Controls are for the keyboard (a bit awkward at first but eventually mastered) or joystick. The front shovel mops up the forest and undergrowth, stoney ground etc. while the back shovel can be used to dig holes (small or large) into which hopefully the Meanies will fall. You then have to dig furiously to fill in the hole behind them before they have time to wake up and resume being mean.

Sound can be turned on and off and there is the now usual pause button. Everytime you put eight Meanies to sleep you get another different coloured and more difficult bunch to deal with. One of the highlights of any game is when the Meanie avoids your shovel and jumps up into the cab, dispossessing the driver and trundling off the screen.

The graphics are pretty good with the detail of the JCB, the landscape and even the swell of the sea. The sideways scrolling is smooth enough but a little jerky vertically. This is to do with the number of pixels which have to be moved at a time and certainly does not spoil an excellent game overall. It's the sort of game which is not too difficult to play and demands that you keep on practising to improve on previous performances. Great fun and available on cassette or the new Acorn only combined 40 and 80 track disc format.

Ratings Table:

SOUNDS	75%
GRAPHICS	80%
DOCUMENTATION	80%
VALUE FOR MONEY	70%
OVERALL	75%

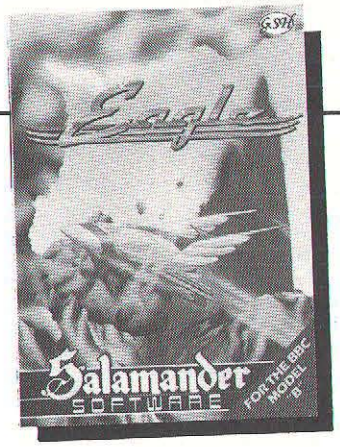
Title	**Eagle**
Publisher	**Salamander**
Machine	**Model B**
Price	**£9.95**

This game is very much like that arcade favourite, HUNCHBACK. The scenario and precise details are altered but the caves of the planet Thrug are certainly analagous with the dark halls of the Palace of Notre Dame.

An amusing prologue is the title page which is displayed as the second part of the program loads. As this happens, the journey from Earth to Thrug is taking place — each block of the second program represents a parsecond.

When the game commences, you must guide your spacecraft, EAGLE through the tunnels of the four moons of Thrug, conserving your energy whilst collecting up 'iridium pods', a mythical rare and valuable trace element (represented on screen by an unexciting full stop). Energy is lost if you collide with the walls or succumb to the various hazards which you must negotiate (e.g. asteroids, laser beams, volcanoes etc.). Each screen finishes when EAGLE safely lands at the bottom of the screen.

Although I did not manage to get very far in my expeditions, I was nevertheless not too impressed by the action. The proceedings simply consisted of moving round the screen, avoiding the odd obstacle — magazine stuff (not ***A&B***!) rather



than true commercial standard. Of course, things may improve later on in the game but the obvious graphics inadequacies are unlikely to be rectified to any great extent.

This program epitomises the attitude of many software houses who believe in bringing out copious quantities of programs of a very variable standard. This probably makes them more money in the short run but at the risk of destroying a customer's faith in commercial software. In addition to this, Salamander have previously been associated with quite decent software so this apparent decline in standards is rather sad to see.

Ratings Table:

SOUNDS	40%
GRAPHICS	35%
DOCUMENTATION	70%
VALUE FOR MONEY	50%
OVERALL	45%

Title	**Bumble Bee**
Publisher	**Micro Power**
Machine	**Model B**
Price	**£7.95**

One more PACMAN clone for the collection is the simple summary of BUMBLE BEE. This version, though, does have something of a difference (dare I say a 'sting in the tail'?).

The screen is colourful and looks impressive. Scattered throughout the maze are various commestibles such as mushrooms and pies. After a quick test, much to my dismay, I discovered that consumption of any of these leads to instant death for the little bee, who is controlled by you. He must move through the complex, collecting up crosses (I'm not sure what these are supposed to represent) whilst avoiding the aforementioned obstacles. After a while, a rather non-descript enemy appears who attempts to catch our insect friend. As time goes by, more of these 'things' appear, making the bee's task more difficult. Bonuses can be scored by eating apples or scoring packets. When all the crosses have been gathered, an exit opens up and a new screen begins — from screens to screen, the only difference seemed to be an increase in the speed of the proceedings.

Sound and Graphics are adequate although not likely to set the world alight. One notable feature is the smoothness of movement; characters glide along most gracefully rather than bumping from point to point like an elephant as in many similar programs.

So, overall, this program, whilst being well presented and fairly interesting, lacks the features and addictive qualities of the really top quality arcade game. I would advise anyone to see it before buying it.

Ratings Table:

SOUNDS	50%
GRAPHICS	55%
DOCUMENTATION	10%
VALUE FOR MONEY	50%
OVERALL	55%

Title	**3D Ice Hockey**
Publisher	**Computersmith**
Machine	**Model B**
Price	**£5.50**

In these days of sophisticated games depicting combat with aliens of every shape, size and form, the original video tennis games seem rather anarchronistic. However, this offering is little more than that.

Each side has two players; the figures representing these are quite reasonable but unfortunately opposing layers are coloured cyan and dark, thus making it awkward to distinguish between them. The two players of one side are moved by one set of controls. The attacking player may move in any direction whereas

CONTINUED OVER

the goalkeeper does not move up the pitch and has only a small modicum of mobility across the goalmouth.

Puck control is rather difficult at first although presumably one becomes more skilled with experience. However, once in possession of the puck, one can dribble it at will until tackled. One of the most disappointing features, is the shooting. Instead of being able to shoot in the direction of present motion, which is the logical arrangement, two controls, "Shoot up" and "Shoot down" are provided. This means it is only possible to fire in two particular directions; a straight shot is completely impossible for example.

The end of the game is most disappointing. No music signalling the finish; or even a congratulatory message to the winner is produced; instead, the screen simply returns to the starting menu after a short while.

Therefore, sadly perhaps, my final message has to be one of warning: Not a worthwhile buy unless you feel particularly nostalgic about that oldest sort of pub video machine.

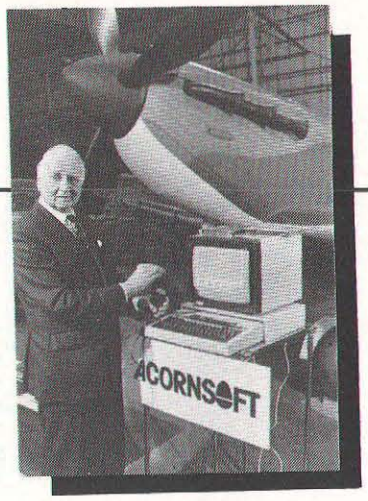
Ratings Table:

SOUNDS	25%
GRAPHICS	30%
DOCUMENTATION	20%
VALUE FOR MONEY	50%
OVERALL	30%

Title	**Aviator**
Publisher	**Acornsoft**
Machine	**Model B**
Price	**£14.95/£17.65**

Geoffrey Crammond spent over nine months putting together this Spitfire simulation including research into the plane itself and an analysis of aeronautics and the physics of flight. Any user (player?) of the program is consequently guaranteed an accurate flight if not a smooth one.

The software has certainly succeeded in capturing my imagination and so far produced some moderately capable flying. Some of the best results I have seen were produced (not surprisingly) by Air Vice-Marshal Sandy Johnstone who flew Spitfires during the Battle of Britain and who helped launch the Acornsoft game.



The cockpit detail is a fairly realistic representation of the original aircraft and much of the flying is done using the various instruments depicted here, the Altimeter, Air and Vertical Speed, Fuel Guage and Throttle. A joystick position indicator and 'radar' spoil things a bit but prove helpful during flight. Both the keyboard and a single joystick can be used to pilot the Spit and the joystick option simplifies things a great deal.

The sounds used to represent the engine are pretty effective although 'realistic' is going a bit far for the capabilities of a computer sound chip. The 3D graphic landscape which houses the game is amazing, and the features are laid out on a map which is part of the immaculate package which accompanies the game. The manual apparently simulates the original Spit manuals in many ways.

The 'challenge' to Aviator beyond getting off the ground and flying around safely is to succeed in completing a number of aerobatic tests of skill, including looping the loop and flying beneath a bridge. Points also accrue for landing and taking off again without mishap, or weaving amongst the buildings which make up Acornsville, a 3D township in the Aviator world which extends for approximately 15 square miles around the airstrip.

There are many subtleties of control which are discovered as you go along and the plane is very responsive to anything you might want to try. It's reassuring to know that you can practice without fear of endangering anyone below. All eventualities are dealt with, including things like taxiing off the runway and landing on a river bank!

If you require further stimulation then there is yet another aspect to Aviator — the Theme. This is activated when still on the runway at the start of a flight. It is necessary to navigate to Acornsville to protect the population from some alien invaders — the manual explains this unlikely scenario. The Spit is a bit underpowered for this sort of thing I would have thought but the Theme does add the game playing element without spoiling the training flight aspect which is such fun.

Flying Aviator is great fun and it beats all other BBC simulations for response and graphical interest. The romance of flying a Spitfire and the excellent package which come with the cassette or 40/80 track disc are big pluses. The price reflects the quality of the program and the printed material and even if the individual finds it a bit steep, it should be made compulsory for every BBC in school. Learning to fly would be a popular addition to the curriculum.

Ratings Table:

SOUNDS	80%
GRAPHICS	95%
DOCUMENTATION	100%
VALUE FOR MONEY	75%
OVERALL	90%

Title	**Bel Gen**
Publisher	**Bel Tech Software**
Machine	**Model B**
Price	**£12.50/£13.99**

A bit off the beaten track is this one from Beltech, a new company who intend to specialise in the educational/hobby market. Bel Gen gives the user comprehensive facilities to log information related to their own or indeed anybody's family tree. A Big Brother program for your micro? Perhaps not.

There is no doubt that tracing the family tree has become a popular pastime in recent years and there is no reason why taking the hard work out of it should take the fun out of it. This program should prove very popular therefore with the enthusiasts. Royalty watchers will get a great deal of satisfaction no doubt from mapping the lineage of present day kings and queens, princes and princesses. Indeed one of the data tapes contains information on this very subject.

The program documentation is full of tips on how to get the best from the program and there is a run through of how to input data — the most tedious part of such activities and the one you least want to get wrong.

There is provision for dates of birth and death and a field for occupation/place of birth etc. plus a maximum of three spouses (perhaps the one constraint in the program that might conceivably matter).

The sort and printing routines allow the user to follow a particular route through the family tree and to search with a particular option in mind. There are also full data saving routines with checks to make sure that you can't lose any valuable information.

Bel Gen seems to be the ideal package for anyone who spends his/her leisure hours in the pursuit of family or local history. Schools will undoubtedly be able to make use of such a program in any sort of history lesson; the relationships of the Caesars for instance would make interesting printout! The program might (though I doubt it) convert some Beeb users to a new, more traditional hobby.

Ratings Table:

SOUNDS/GRAPHICS	N/A
DOCUMENTATION	80%
VALUE FOR MONEY	80%
OVERALL	85%

Title	**Croaker**
Publisher	**Program Power**
Machine	**Electron**
Price	**£7.95**

Most readers will have read of the exploits of the frog that cannot swim, but which tries desperately to cross a busy highway with fast traffic (including racing cars!), merely to reach a river with

assorted beasts swimming, and eventually to squeeze into a hole in the bank. The frog, under its various guises, has become as well known as Space Invaders or Pacman to arcade fans, and this offering will not disappoint Electron owners. It contains most of the features which might be expected, although there are no features which will make this version stand out from all the others.

It begins at a very reasonable level, which means that children or less-experienced beginners will not be overwhelmed. The tactics built up in the early stages will stand the player in good stead for later stages when the going becomes much more difficult. There are more problems getting safely to the left-hand hole than the others, and this difficulty increases when the crocodiles appear from screen two onwards. Diving turtles add further problems, and the author's claimed top score of over 12,000 would seem fairly secure (I couldn't get within a thousand of it.)

One annoying feature is the little tune which merely serves to distract. I was very pleased to be able to turn it off, and even happier to find that the sound effects offered instead were much more realistic. Yes, make friends with Croaker, and hop to it!

Ratings Table:

SOUNDS	65%
GRAPHICS	70%
DOCUMENTATION	75%
VALUE FOR MONEY	70%
OVERALL	70%

Title	**Felix and the Fruit Monsters**
Publisher	**Program Power**
Machine	**Electron**
Price	**£7.95**

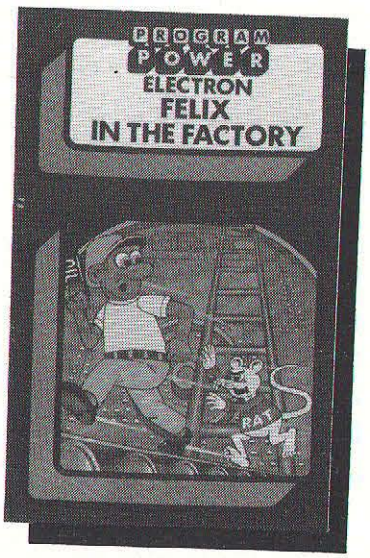
When I had previously seen this tape advertised for the BBC micro, I had assumed that its parentage was the famous Pac family of Arcade lore and legend. While this assumption is not entirely false, it is equally not a complete truth, for the scenario includes a few novel ideas The power pills still appear, although they no longer give the player the power to chase the ghosts, merely to increase the energy level.

This energy level is important, as there are only three main ways to stay alive in this game. The object is to remain alive until the counter ticks slowly to zero, while being pursued by ghosts. There are pieces of floating fruit in the maze, which help the ghosts to mutate into even nastier beings, and so it is possible to move the fruit to places of safety, although one at a time is very tricky. There are also ether pools which can be laid, which have a soporific effect on the chasing ghosts, but only for a while. The other, and far more radical, possibility is to trigger the magnetic pad which transports all the monsters back to their cave, but which is apt to use a lot of energy.

I found the controls confusing at first, and I am forced to admit that I haven't become good enough at the game yet to enjoy it. My co-player is just six, and I always like an easy start to any new game so that he can reach a level of success. This game, unfortunately, begins hard and ends up well nigh impossible!

Ratings Table:

SOUNDS	70%
GRAPHICS	85%
DOCUMENTATION	75%
VALUE FOR MONEY	80%
OVERALL	80%



Title	**Bandits at 3 o'clock**
Publisher	**Program Power**
Machine	**Electron**
Price	**£6.95**

Perhaps it is because this is basically a two player game, but I must confess I have wondered more than once while reviewing this program why Program Power should include this in their superb range of programs for both the BBC and the Electron. It is a fair display graphically, and the idea is also quite sound, but the usual slickness and style which puts Program Power in a class of its own is totally lacking in this offering. Instead there are jerky movements, so reminiscent of one's own attempts in BASIC animation until one had enough practice to do it properly, and screen displays which can be said to be rather simple.

The idea is that there are two planes which take to the skies over Belgium (although I'm not sure why it should be Belgium rather than anywhere else!), and have a dogfight until one has crashed seven times (you have to admire the courage and tenacity of these airmen!). There are various options, some of which greatly improve the game, such as some well-drawn airships which might fire at you if you venture too close.

However, there are a few glaring faults with the program which are most unusual for this Software House. Firstly, the planes are identical in shape and colour, which does not help recognition when the action does become fast and furious. Although we are presumably in a four colour mode, I would have thought that some obvious difference could have been implemented. Secondly, my co-pilot is only six and he loved this game. However, he did find it difficult understanding that the control for UP is below that for DOWN. Lastly, there are times when the planes fly straight through each other with no ill effects, presumably meant to indicate perspective, but rather annoying. All in all, an interesting program for many reasons, but one you will either love or hate.

Ratings Table:

SOUNDS	50%
GRAPHICS	45%
DOCUMENTATION	70%
VALUE FOR MONEY	40%
OVERALL	45%

Title	**Moonraider**
Publisher	**Program Power**
Machine	**Electron**
Price	**£7.95**

Before moving onto the Electron, I owned a Spectrum, and one of my favourite games on that machine was Penetrator which was the best home-computer version of Scramble I had come across. As well as being true to the original, it was also incredibly fast. I am delighted to say that after playing Moonraider almost non-stop since receiving it for review, I am as firmly hooked onto this version as I ever was on the Penetrator game.

The scene should be well known by now, with a small spacecraft flying over undulating terrain and through caverns and passageways, trying to battle past rockets while bombing radar scanners and fuel dumps. This bombing of fuel dumps is actually a rather unorthodox way of refuelling in flight(!), the other method being to dock between stages. All your favourite stages are there, including the silos and the bouncing OFOs in the cave, with five distinct phases. It is possible to select any stage on which to start at the options page, although unlike Penetrator it is not possible to get a limitless number of craft for practice. One outstanding feature is the chance to redefine the keys to be used during the game, this choice only being possible once, at the very start of the action. Actually, I did usually take advantage of a minor alteration here, and so I am sure will many other players.

With Program Power such an established software firm for Acorn micros, it hardly needs adding that the graphics are smooth and slick, with the scrolling screen faultless. Whether you are a scramble fan, or you are

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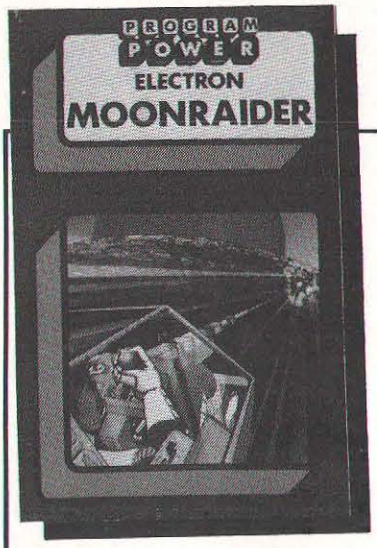

looking for a superb game or even if you just want an idea of what the Electron can produce in terms of speed, graphics and sound, then Moonraider is the program for you!

Ratings Table:

SOUNDS	85%
GRAPHICS	90%
DOCUMENTATION	70%
VALUE FOR MONEY	80%
OVERALL	85%

Title	**Swoop**
Publisher	**Program Power**
Machine	**Electron**
Price	**£7.95**

This program can claim the ultimate accolade in my household; my wife had always replied 'Computer Widow' to any enquiry about her occupation, but now she even admits herself to being hooked on this superb game from Program Power. The loading, as might be expected, is absolutely trouble free and the keys to be used are clearly shown on-screen during loading. There are four skill levels which can be selected at the outset of each game, but once the action starts there are problems which increase with every screen.

The scenario is obviously a Galaxians clone, with swooping birdmen attacking in twos or singly, and in varying patterns of flight. It is the speed of the play which has already been determined by the choice at the options page, but even at the easiest level, the action is fast, furious and great fun. Program Power had rightly gained a very good reputation for their graphics implementation on previous tapes for the BBC, and they maintain the standard here. The birdmen flap their wings realistically, and the smoothness have to be seen to be appreciated. Although the Electron lacks the sound commands of its bigger brother, the program exploits them to the full to provide a stimulating background to the battle.

If you only intend to buy one game for the Electron, then I would most strongly recommend this one. It is great value.

Ratings Table:

SOUNDS	85%
GRAPHICS	80%
DOCUMENTATION	75%
VALUE FOR MONEY	80%
OVERALL	80%

Title	**Constellation**
Publisher	**Superior Software**
Machine	**Electron**
Price	**£7.95**

My interest in Astronomy has never been particularly great, so when this tape arrived, I put off reviewing it for a couple of days. Since then, however, I've returned to it time and time again, as it is a fascinating and excellently written program. The idea is fairly original, showing the stars as seen from my point on Earth at any time of any day of the year. I would merely stand in awe of the programmer who set out to do this mammoth task, for the program seems to be quite faultless.

When loaded, which is straightforward and trouble-free, there are screen prompts to obtain the position of the viewing base, by latitude and longitude, and also the date and time. The elevation and rotation of the telescope are then required for the universe to be revealed. For people like me who don't recognise a Great Bear if we see one, there is even an option which shows the constellations on view in that sector by code letters, which can then be looked up in the notes. Small movements may be made from that position, which saves inputting much of the same information, and a zoom feature is also available.

Budding Patrick Moores will need little convincing about the program, it is a tape well worth purchasing.

Ratings Table:

SOUNDS	N/A
GRAPHICS	95%
DOCUMENTATION	100%
VALUE FOR MONEY	95%
OVERALL	95%

Title	**Games One**
Publisher	**Micro-Aid**
Machine	**Model B**
Price	**£4.95**

Micro-Aid have packaged some of their BASIC games into one compilation at an attractive price. We have done them the honour of reviewing each game on its own merits.

BATTLE

This is a game for one player, who has to move from the bottom left of a 10 × 10 grid to the top right, or the "Home Base", using the cursor keys, avoiding mines on your way. These mines cannot be seen but you are told how many mines are around you each move, but this facility only lasts for the first twenty moves: after this, you are completely unaided, but the score for each move increases accordingly. A time limit is imposed on the game, a bonus being gained for completion of the course in under a minute, but you are blown up, and your score halved if you take over two mintues.

Other methods of deleting your score include trying to walk off the edge, which knocks off fifty points, or hitting one of the non-explosive obstacles, which leaves you dazed, and 100 points poorer. When the game is first loaded, a union jack is drawn, and your computer goes into a very tuneless hammering of machine guns and other non-laser weaponry. If you fail to press "N" within a couple of seconds, the instructions are then displayed, and these are followed by the game proper. The grid is drawn and you are shown as a very insignificant little man perched in the bottom left corner. The time is shown ticking away together with the number of mines around you at that particular time.

To sum up, this is a very simple game, written in BASIC, and consequently, it is nothing spectacular. I would not recommend this game, as it does not make any attempt to stand up to the competition that it is given by other strategy games, such as adventures, or role playing games of the Kingdom genrae.

DARTS

It tooks me almost half an hour to work out what this program was supposed to do. When I finally did, I wished that I hadn't bothered. This is one of the poorest excuses for a piece of software I have seen in a long time...

When you first load Darts, a very pretty high resolution multicoloured darts board is drawn up, and you are asked whether you play the "no bust" rule. My knowledge of the technical side of the game being somewhat limited to say the least, I resolves to say Yes, and hope for the best! This I did, and the program seemed to work OK. Then comes the real fun. The computer asks you what standard of player you are, on a scale from 1 to 100. I entered 1, (as I usually do on new games, being of a cowardly disposition), and on completing the rest of the questions which consisted of start number (301,501 etc.) do you want to play a double to start, and do you want to go first (stupid question!), I expected to see some form of representation of an arrow on-screen. No such luck! The computer asked what I had scored!!!!!! I switched off the machine, turned off my graphics ROM, and re-run the program, thinking that it must use machine code, and the ROM upsets it, as it does some other programs. Exactly the same procedure followed.

Then, It finally clicked. This was a darts practice program, and you

were supposed to have a dart board pinned up on your wall opposite your computer, and sit there throwing your darts, entering your score, and waiting to see what random number your computerised opponent could come up with. To be fair, the program doesn't just use random numbers. It does give quite an accurate response depending on what skill level you put in. The computer misses the board more often than not on the lower levels. I would hate to see the walls in the programmers house!

To sum up, this program is really not what one would expect to see in this day and age. I would not expect to see this kind of software published for the ZX-81, let alone a machine with a reputation like the BBC micro. The high-res board is very pretty, but it serves no purpose whatsoever, apart from making the screen display look a little more pleasant. Please, Micro-Aid.. take this tripe off the market.

CARDS

This is a computerised version of the game played on the TV series "Play your Cards Right". The object of the game is to guess whether the next card is going to be higher or lower than the previous one. If you manage to do this correctly for five turns of the cards, you have managed to win a game! When I first run this game, I expected to see a graphic Bruce Forsyth, or at least his chin jutting out of the screen in 3D. No such luck, however, but the instructions supplied were short, and clear, and after a short musical gurgle, the game begins.

The screen display shows graphically the cards that you have. Kings, Queens and Jacks have the words written on them, and not the actual pictures. At the bottom of the screen the computer tells you how many cards you have turned over in total, and at the top, it gives you an indication of how many games you have both won and lost. If you guess incorrectly, a buzzing noise greets your ears, but if you win, the computer plays the most tasteless "tune" I have ever heard! It really makes you cringe. Its the musical equivalent of someone scraping their fingernails down a blackboard. After five games, the screen clears, and you are told how many games you have won, and how many you have played in total.

This is one of Micro-Aid's better games, and can be quite good fun to play. The graphics could be improved, however, by, say drawing the cards face down first, and then "turning them over". All in all though, this is an enjoyable game, and, together with the lack of Bruce Forsyth, makes an interesting change from watching the TV series.

PONTOON

This is yet another version of the old card game, pontoon, or Blackjack. For those who have only just landed on this planet, there is a short run down of how you play the game... The object of the game is to get 21, or below 21 as close as possible. You can either twist or pass, ie take another card from the dealer, or "Stick", staying with the cards that you have in your hand at that time.

The computerised version of the game consists of you, the player, and the computer, who acts as the dealer. The customary two cards are dealt to begin with, and the game begins. The cards are displayed graphically, and you choose whether to twist or pass by pressing the keys "1" or "2" respectively. When you have finished playing (or if you "bust") the computer takes its turn, and invariably wins. The score is shown as games won by the player, and games won by the computer.

There is no sound in the game apart from something that sounds rather like indigestion at the very beginning. The graphics for the cards display is average, but by no means is it anything spectacular. There is no provision in the game for buying cards instead of twisting, nor does the game give you the true "betting" feeling by giving you an amount of money with which to play. To sum up, this game is, quite simply average. It does not make any effort to compete with Superior Software's or ***A&B***'s game of the same name, and I would not recommend this game to anyone except the absolute card games fanatic.

MRMIDON

Mrmidon sounds rather a peculiar name for a game. In fact, the blurb in the instructions relates that the Mrmidon is, in fact, a mythical creature that lives on an island consisting of a 12 × 12 grid.

The object of the game is to capture the Mrmidon. This is done by preventing it from being able to move. At the start of the game, you are shown where the Mrmidon is, but after your first move, the creature becomes invisible, just to add a little excitement to the game. You are given 12 men, placed at random positions on the grid, and you are allowed to move any two of them a maximum of three positions each. Then, the Mrmidon moves, then you, and so on. You must capture the Mrmidon within 36 moves. Normally, the Mrmidon moves up, down, left or right into an empty space, but he will move diagonally onto a space occupied by one of your men, and enjoy a quiet snack. This can be quite a useful way of dining out where the Mrmidon is. Every 5th move, an extra man is added to your forces, and you are asked whereabouts on the board you would like to put him.

The game was supplied on disc, together with a number of other programs for review. When I first selected the program, I read the instructions, but when it came to moving a man, the program crashed. This was found to be due to a memory shortage, as I had the Disc Filing System installed. This sort of bug is totally inexcusable when the program is actually supplied on disc. However, the addition of a small relocating program at the beginning soon righted this wrong.

The game itself is not terribly interesting, and I found that it could not hold me at the keyboard for as long as most of the software that I had. However, the game would be very useful for schools who were doing a project on co-ordinates, and I would imagine that younger children would enjoy planning out the moves. I would not, therefore, recommend this program to home users, as there are many tactical programs on the market which far surpass the quality of this, and which provide much greater value for money.

Ratings Table:

SOUNDS	40%
GRAPHICS	50%
DOCUMENTATION	50%
VALUE FOR MONEY	60%
OVERALL	45%

Title	**Snorter**
Publisher	**Beebugsoft**
Machine	**Model B**
Price	**£7.50**

This game is an original from Beebugsoft, the software department of the BBC user group. The game involves you, the snorter, and the snakes, made up of red circular segments, which rush around the screen chasing after you. There are various barriers which both hinder your efforts, and provide a refuge from the snakes.

Also on the screen are a number of moveable fences, and the idea of the game is to shunt these into the snakes, who then promptly disappear. You have a time limit in which to kill off the eight snakes which make up a

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screen. You die if your time runs out or if you hit a snake.

The game has ten levels of difficulty, ranging from zero (quite easy) to nine (suicidal). The higher the level of difficulty, the faster and the more intelligent the snakes. In the centre of the screen the number of snakes left for that level and the number of snorters left is displayed, and when you clear a level of all its eight snakes, you progress to the next, more difficult level.

This game is quite good value for money at £7.95, and is very fast on the higher levels. The graphics are colourful, and the sound quite good. Don't expect Snapper MK.II, but this is a highly enjoyable game.

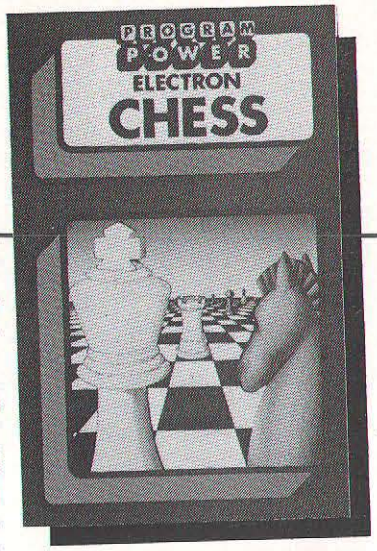
Ratings Table:

SOUNDS	75%
GRAPHICS	75%
DOCUMENTATION	60%
VALUE FOR MONEY	75%
OVERALL	75%

Title	**Chess**
Publisher	**Program Power**
Machine	**Electron**
Price	**£7.95**

When micros were first thought of as possible chess opponents, the prospect of programming such a complicated and involved game even onto a mainframe, must have seemed daunting. Now Program Power have packed into the Electron's modest 32K memory, a program which can realistically reproduce all the finer points of chess rules, but which can also play at a wide range of levels.

As usual, loading is child's play, and is followed by an options screen which can allow dozens of permutations. The default colours of the board are red and green, with black and white pieces, but any of the Electron's eight colours may be selected at will. Yes, anyone who fancies invisible chess can now try it! Actually, I found the default colours to be a well chosen selection.



Perhaps the simplest option at this point is play, but even this has a number of levels. I found levels one to five to be fair competition for me, playing a straightforward, if rather orthodox, game. The great snag, of course, is that an increase in level means a large decrease in speed, and the higher levels would appear to be rather boring, with the micro making perhaps a dozen moves a day!! However, most of us would find the levels offered to be quite sufficient. There is also an option to play Blitz chess, with only a certain time allowed for reply. The adrenalin flows well then!

One extremely useful feature I found with schoolchildren was the option to replay a previous game move by move, and to continue from any chosen position. By clever use of the facilities, it is therefore possible to take back a move and to make a better one instead. Perhaps the only option which I have seen on other chess games for other micros which might be missed is the option to ask for a suggested move — all the other features anyone might want are included. A good buy.

Ratings Table:

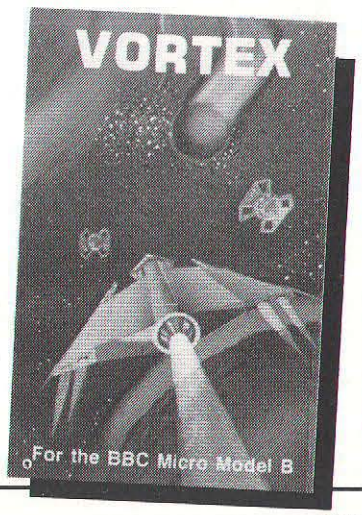
SOUNDS	N/A
GRAPHICS	100%
DOCUMENTATION	80%
VALUE FOR MONEY	100%
OVERALL	95%

Title	**Vortex**
Publisher	**Sofware Invasion**
Machine	**Model B**
Price	**£7.95**

I think that Software Invasion will be forced to change their name to Sanity Invasion after the release of their latest game: Vortex. Continuing in the 3D genre, Vortex is one of the best games I have ever seen.

Vortex consists of some sort of black hole (called the "Black Void") which is endeavouring to pull in your craft. The closer you get to the Black Void, the faster you move, and your score increases every 100th of a second you manage to survive. Then you have the aliens to contend with. These video nasties zoom in at you, firing as they come, and each shot diminished your shields. You in turn can also fire back, with each alien being worth another hundred points to add to your total. Not being content with simply moving left and right like any normal game, in Vortex, you actually swoop left and right in true 3D manner. The graphics for the ship are very good indeed, and the way in which the stars zoom towards you in 3D is quite unnerving.

The worst, however, is yet to come. When (or should I say if) you manage to annihilate a swarm of aliens, you get the meteors. The speed of these things is incredible. I have seen peoples eyes protrude from their heads when they have started on this level! When you swoop left and right trying to dodge the meteors, you find yourself instinctively leaning over to the side in which you are turning, trying to get that little bit of extra speed! It's quite fascinating watching people play this game at computer clubs or in shops. Their characters change completely. I have seen sane human beings reduced to gibbering wrecks after only a few games. The faster the game becomes, the closer people sit to the screen, and then, when the inevitable happens, and they lose a ship, the explosion leaves them flash-blinded.



Unlike the other Software Invasion 3D games, Vortex only uses black & white graphics, but this lack of colour is made up for by the quality and speed of the graphics. This program will account for 75% of all admissions to lunatic asylums over the next few months. Sanity...sorry Software Invasion...PLEASE don't bring out any more games like this... My brain couldn't stand the strain!

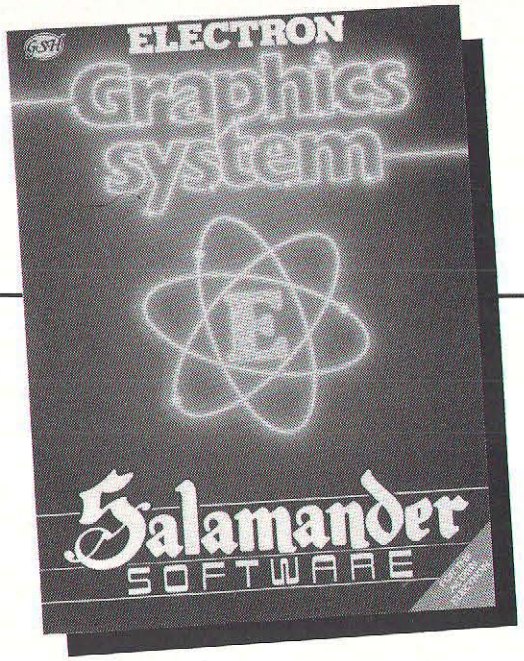
Ratings Table:

SOUNDS	75%
GRAPHICS	90%
DOCUMENTATION	N/A
VALUE FOR MONEY	85%
OVERALL	85%

Title	**Graphics System**
Publisher	**Salamander**
Machine	**Electron**
Price	**£9.95**

Many new owners of this marvellous machine will know that the screen resolution can be set to any of several values, and they might also know that the highest resolutions allow very detailed and accurate drawing. However, not everybody will be able to delve into the delights of DRAW, PLOT, MOVE, GCOL etc. It is for them that this package will be absolutely perfect, but many other owners of Electrons will appreciate the tremendous ease with which this cassette will allow them to create intricate drawings and diagrams.

Taking the cassette and booklet from the usual Salamander video type case, the first impression made me a little nervous, but within a very short time the controls and facilities become second nature. Many of the keys are chosen for their initial, T for instance allowing Text



to be input. There is a choice from modes 0, 1 or 2, each giving a different choice of pallette, although these colours can be simply and instantly reset to any of the Electron's 16 combinations. The current position of the cursor is displayed clearly so that pictures previously drawn on graph paper may be faithfully reproduced. It is also possible to draw within a grid, and lines may be drawn dotted or solid. The PLOT 85 command has a simple replacement in F (for Fill), although some complex shapes took several separate F commands to finish. Pictures drawn in one mode may be redrawn in another, and pictures may be saved and reloaded onto cassette. The demonstration figures supplied on tape do not show off this program to its best advantage, it has a great deal of potential.

Ratings Table:

SOUNDS	N/A
GRAPHICS	90%
DOCUMENTATION	90%
VALUE FOR MONEY	95%
OVERALL	90%

Title	**Dodgy Dealer**
Type:	**Tape**
Publisher	**OIC Software Ltd.**
Machine	**Model B**
Price	**£6.50**

This is a game in which you set up your own business. You are given a warehouse and office, a £5000 bank loan and a van. First of all expert advice is needed, which costs up to £1111.11 depending on the amount of advice. At the beginning of each trading period you must decide how to invest your money. The options are: buy new machinery; buy vehicles; repay your bank loan; invest in research and development; invest in marketing and advertising; and of course make the goods. You must decide on the selling price. If you invest wisely, a profit will be made; if not you may go bankrupt (and see where you come on the Top Ten Company list!!)

A lot of thought has obviously gone into this program, as it is extremely complex and well programmed. The instructions are clear, and there is even a special sealed part to open if you find it very hard to progress.

However, to me it seemed far too hard to succeed. Even the sealed instructions did not help; after maybe six or seven trading periods I went bankrupt. Consequently, I quickly grew bored of the game. I would say that it is a very good idea, but it should be made easier to play. I am sure that it would then be a very good game.

Ratings Table:

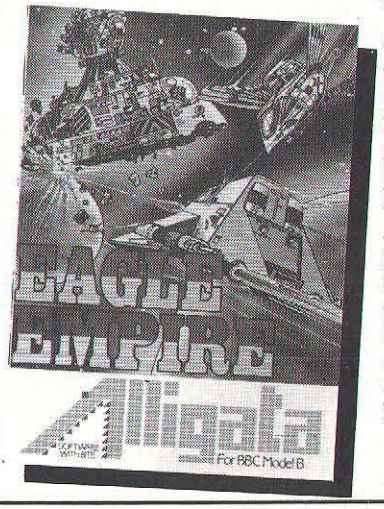
SOUNDS	N/A
GRAPHICS	N/A
DOCUMENTATION	70%
VALUE FOR MONEY	50%
OVERALL	55%

Title	**Eagle Empire**
Publisher	**Alligata Software**
Machine	**Model B**
Price	**£7.95**

This is a fairly accurate version of the popular arcade game, "Phoenix". There are five different attack waves, and to deal with them your laser base is equipped with a shield mechanism and an unlimited supply of laser shots. In the first two waves birds swoop at you, dropping an alarming number of bombs. When these two waves have been dealt with, the eagles of the title appear; first as eggs which soon hatch into massive birds, gently swooping down the screen from side to side, flapping their wings as they go. The eagles can only be destroyed by a direct body hit; if the wings are hit, no damage is done.

After two sheets of these monsters, the dreaded 'flagship' is encountered. A large space ship is displayed with the 'master alien' in the middle; he must be shot to finish the sheet. To reach him a large amount of the ship's hull and a revolving centre ring must be shot through; bearing in mind that the spaceship is advancing down the screen towards you, dropping bombs all the time. When he is eventually destroyed, a bonus is awarded, ranging from 800 to 9000, depending on how much of the ship you have shot away. The more you have shot away, the bigger the bonus. Then the wave sequence is repeated, until you lose all of your lives. An extra life is awarded at 10000 points.

The game is very fast, being written in machine code. The graphics are smooth and the sound effects are not bad either. Although the flagship sheet is not as complex as the arcade game, this can hardly be expected from a tape based game on a small microcomputer. I found a bug which fouls up the game occasionally. On the fourth flagship sheet, I destroyed the alien, was awarded a bonus and then my lives were both blown up for no apparent reason! Apart from this, a very good game.



Ratings Table:

SOUNDS	65%
GRAPHICS	80%
DOCUMENTATION	N/A
VALUE FOR MONEY	85%
OVERALL	80%

Title:	**Lemming Syndrome**
Publisher:	**Dynabyte Software**
Machine:	**Model B / Electron**
Price:	**£7.95**

Dynabyte certainly like the off beat in subject matter when it comes to games. This one involves a fleeing human population diving off the bank of a river in alarming quantities, ostensibly because Mad Marco has blown the bridge and is on the rampage. You take on the role of saviour in the form of Lifeboat Lennie. You have a makeshift raft which is simultaneously under threat from Mad Marco himself (dynamite) and the evil looking shark which silently patrols the waters and can sink your chances with a single swipe of its fin.

Two methods of play are offered during the instructions$options part of the program: these amount to having full control of the raft yourself or alternatively allow the program to help out a bit by placing the raft in one of three suitable spots on the river. The machine code propelled people rush headlong over the edge and it is up to you to be beneath them at the right time. It takes them all more than one leap to make it over the river so you need some of the skills you may or may not have picked up playing Breakout type games.

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Varying combinations of gesticulating refugees dive off the bank and the timing of these leaps gets more rapid and less ordered as the game progresses. The absolute option (help) is manageable but the positive option (on your own) is manic. The background graphics are crude 3D but serve as an effective backdrop to this strangest of games. The Electron version obviously lacks the Mode 7 kaleidoscope of colour in the instructions but more importantly, it also lacks the necessary speed to make the game interesting. The movement however remains smooth and some of the graphics (the shark's teeth and the water splashes) can be seen in more detail. The sound is well chosen to reflect the arcade nature of the game.

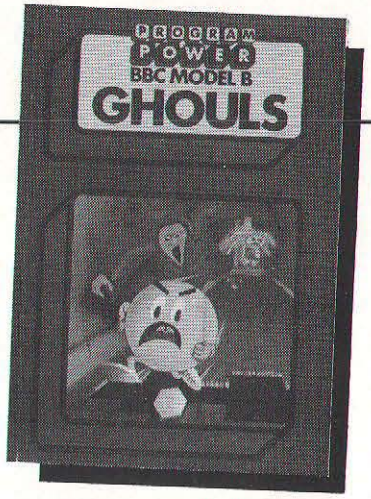
Ratings Table:

SOUNDS	85%
GRAPHICS	85%
DOCUMENTATION	75%
VALUE FOR MONEY	85%
OVERALL	85%

Title	**Ghouls**
Publisher	**Micro Power**
Machine	**Model B**
Price	**£7.95**

Ghouls is a sensational game full of all the features arcade fanatics hold most dear. The loading process hints at the excellence of the game to come with a colour switching title page and some ghostly music to serenade the waiting player. The music starts quiet and builds to a crescendo to herald the start of the game proper.

The idea is to get through a number of desperately difficult screens to rescue the power jewels from the creepy mansion at the top of the hill. Spectre's Lair is the first screen to confront you and each step of the way is fraught with danger. Your 'Pac-man with legs' has to run and jump his way up to the top of each screen without missing his step and falling or bumping into one of the unfriendly objects



along the way, including a homing ghoul which smiles broadly at each failed attempt.

In the Horrid Hall, the Spider's Parlour and Death Tower, you will need to jump over poison spikes, jump on and off moving platforms and propel yourself with the aid of springs. At all times you score points by eating yellow titbits and there is the odd power pill which makes the ghost disappear for about 15 seconds.

You can't hang around either since a 50 point bonus counts down in the top right hand corner and you have to make the top before this reaches zero. Ghouls contains some very fine tolerances and this makes each jump or movement a challenge to the player's skill.

Ghouls has the most impressive start to any game I have seen. The old screen scrolls left to the sound of screeching and the new one rushes onto the screen in mixed up fashion and miraculously sorts itself out into the game screen format. This is a very nice effect indeed. We also have, in Ghouls, some of the best sounds in any game available for the BBC. The best thing about them is that they fit the ghostly context. There is also a nice 'splat' as your character hits the floor. Hi-score table and instructions are included in the program. Ghouls is an enthralling and challenging game.

Ratings Table:

SOUNDS	100%
GRAPHICS	85%
DOCUMENTATION	75%
VALUE FOR MONEY	90%
OVERALL	95%

Title	**Alien Destroyer**
Type	**Tape**
Publisher	**Beebugsoft**
Machine	**Model B**
Price	**£7.50**

This is yet another (yawn!) version of the father of all modern video games — Space Invaders. Your laser base must destroy aliens dropping bombs as they advance down the screen from left to right. The laser can hide behind one of three shields, and a spaceship occasionally flies over, which scores 100 or 200 points. The game is over when the invaders land (i.e. reach the bottom of the screen) or when all of your three laser bases are blown up. A bonus base is awarded after the second wave of invaders has been eliminated.

This version offers a high score table and multi-coloured hi-res graphics. The sound is also good, but I quickly grew tired of it, as after four years of playing, Space Invaders of any type bores me to death. Quite a good version: good value if you are a Space Invaders fan.

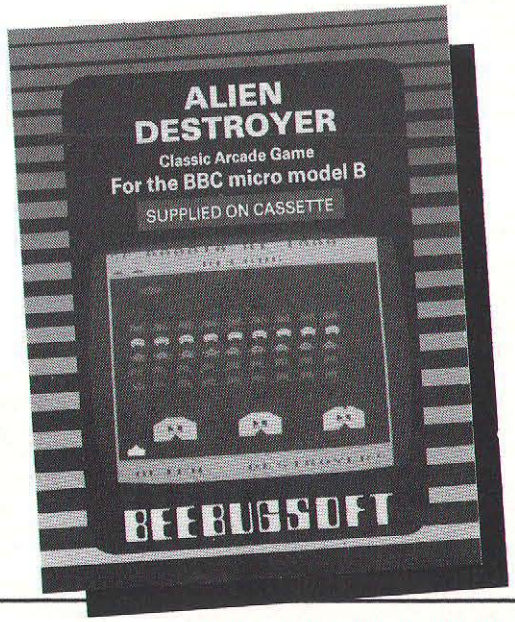
Ratings Table:

SOUNDS	65%
GRAPHICS	65%
DOCUMENTATION	N/A
VALUE FOR MONEY	70%
OVERALL	65%

Title	**Kubla Khan**
Type	**Tape**
Publisher	**Blue Moon Software Company**
Machine	**Model B**
Price	**£8.95**

This is a text only adventure game based loosely on the famous poem, "Kubla Khan", by S.T. Coleridge. I was not able to obtain a copy of the poem while reviewing the game, but I suspect that it might contain clues. The game is similar in most respects to other adventure games; you must explore Xanadu, picking up objects and hints, presumbaly to enter Kubla Khan's castle, although I have not got in yet. The object of the game is to find Kubla Khan's treasure chest.

Despite being quite long and complex, the program has many bad points. Firstly, there are no instructions or indications of the commands understood, making it a bit hard for beginners to get going. There are no abbreviations of commands (apart from N,S,E,W); this is irritating, especially when you have to type in commands like INVENTORY in full! There is no SAVE game feature for unfinished games, meaning you have to start right from the beginning every time the game is loaded. The responses eg. "I don't understand" are pretty uninformative, giving no idea



as to how to string together words to do a certain thing (such as jumping into a lake).

Overall I think that I would be prepared to pay an extra one or two pounds for a game such as Colossal Adventure from Level 9 Software, which offers more features, and a better game. If "Kubla Khan" was refined and then re-released at the same price, it would be good value for money.

Ratings Table:

SOUNDS	N/A
GRAPHICS	N/A
DOCUMENTATION	N/A
VALUE FOR MONEY	50%
OVERALL	50%

Title	**Cybertron Mission**
Publisher	**Micro Power**
Machine	**Electron**
Price	**£7.95**

Cybertron Mission presents the game player with a bit of everything. It's a maze game with each maze forming a room in an adventure requiring a number of objects (key, pot of gold etc.) to be found, plus arcade action as your character fights off various unfriendly creatures intent on ending his stay in the stronghold of Fort Cybertron.

The Spinners, Clones and Cyber-droids form the opposition as you move around the 16 (4 × 4) rooms on each level. There are four keys to control direction of movement and fire and holding down two at once can achieve diagonal aim. Once the treasure from each level has been picked up you can move on by locating and touching the safe. It is a good idea to use the Pause key now and then to update your map of the rooms and their exits plus contents.

All too often our brave adventurer sizzles, an electrified skeleton on the maze wall, or scorched by a Spook (they appear pretty swiftly if you hang around in a room too long). Once you get used to the keys and the fact that you always shoot in the direction in which you are moving then this game has a lot to offer as you go sear-

ching for more objects and another high score. A mission worth going on.

Ratings Table:

SOUNDS	75%
GRAPHICS	85%
DOCUMENTATION	80%
VALUE FOR MONEY	85%
OVERALL	85%

Title	**Positron**
Publisher	**Micro Power**
Machine	**Electron**
Price	**£7.95**

Positron is a super fast shoot 'em up spectacular of the Space Invaders ilk. Instead of invaders, you get waves and sheets of Cybers, Spazmoids. the Galactic Hulks, Hep-Heps by the dozen and the almost unstoppable Mega-Bods.

A 60 line BASIC header *RUNs this headlong dash to destroy as many on-screen nasties as possible within the constraints of your three lives (an extra one at 100,000 points — how generous!). I can't think of an easier way of wearing out the Electron RETURN key than playing this game for a few hours; and that is just what you will do as soon as you sit down in front of the keyboard. This game is super addictive and only 'Positron wrist' will finally persuade you to give it a rest.

The controls are CTRL, A, and RETURN. Your laser base moves swiftly across the bottom of the screen searching out the most efficient method of vapouring the attackers. When you do get hit by the return fire, the particles go flying and reconstitute for a new start at the centre. If you successfully destroy the current wave then the base remains in position for the next attack. Every so often you will be destroyed but your final shot goes on to avenge you and complete the attacker's demise. Good smooth graphics and appropriate sounds. It may be mindless but it's fun.

Ratings Table:

SOUNDS	70%
GRAPHICS	80%
DOCUMENTATION	80%
VALUE FOR MONEY	85%
OVERALL	90%

Title	**Dallas**
Publisher	**Cases Computer Simulations**
Machine	**Model B, Electron**
Price	**£6.95**

This program has already proved to be most successful, with many owners of Spectrums having already done battle across the oil fields with J. R. Euing (no, not a spelling error, but any similarity between this J.R and any other is entirely intentional!) The basic storyline is also rather familiar, with your oil company trying to outwit and outdrill the other outfit.

The program begins with a superb implementation of the Dallas theme tune, before a map of the area is drawn onto a grid. The key to the graphics detail the physical features, but it is up to you where to make test surveys. The results of these may or may not help when the drilling concessions come up for auction. Your bid might be successful, although I found I had a talent for investing millions on sites which produced poor survey results. Still, even a couple of these would occasionally produce a strike, although others would not justify the cost of moving rigs and making test drillings.

Even a good strike could still bring disaster from tornados, blow-outs or even sabotage (where was J.R. when my pipeline was blown up?). Dealing in millions of petro-dollars certainly stimulates the adrenalin, but I found it a little difficult to immerse myself totally in this game. Perhaps it was the thought of what those Euings were planning to do to me . . . . . .

Ratings Table:

SOUNDS	55%
GRAPHICS	60%
DOCUMENTATION	60%
VALUE FOR MONEY	75%
OVERALL	70%

Title:	**The Quest for the Holy Grail**
Publisher:	**Epic**
Machine:	**Model B/ Electron**
Price:	**£7.95**

This is one of Epic's three new BBC adventure games. It requires 32K to run. It is a text only aventure, written in machine code. The program is in three parts, a musical title, a set of instructions and the code itself.

The object of the game is to search the woods around Camelot to find the Holy Grail, and to return with it to King Arthur, who has chosen you to do the impossible. You are told by Arthur to search for the Magic Fruits of the forest. You may use their powers if all else fails.

Your search will lead through forest, swamp, rivers into a castle (and its dungeons) and you will meet many rather vicious characters on the way.

The adventure has around 230 locations and a wide vocabularly of about 140 words. The game may be saved to tape or disc if you don't finish it in one go. Somehow that's rather likely; it's not too easy. As the game is in compressed code the author has been able to cram it in to 25K in order that it will run on a disc system. This will be of relief to those who have discs and cannot load "Colossal" or such like. Colour has been used but so far I have found no sounds within the game. The response time is superb. There are few, if any, games of this type to boast such quick responses. The game is fairly well packages and the instructions are more than ample.

Ratings Table:

SOUNDS	75%
GRAPHICS	N/A
DOCUMENTATION	80%
VALUE FOR MONEY	75%
OVERALL	80%

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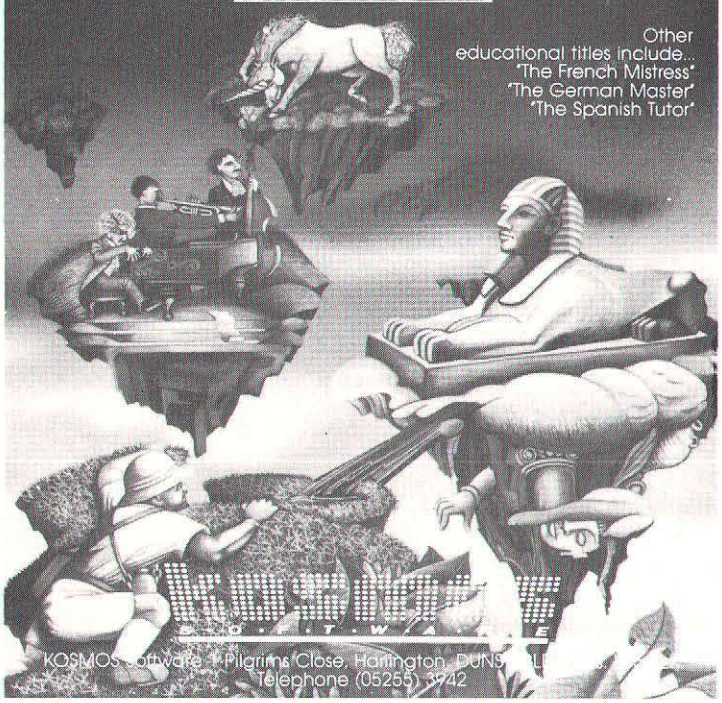

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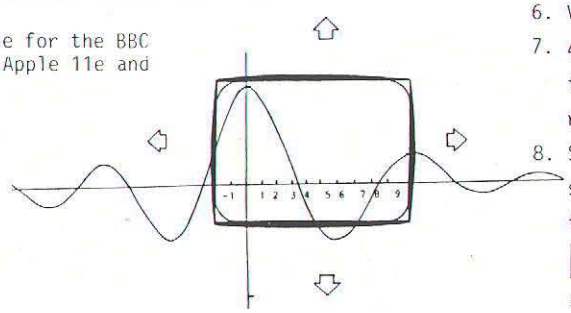

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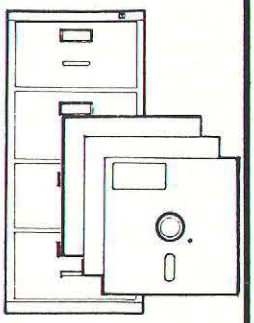

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Sinuous Curving

G.W. Gallagher

Putting the sine and cosine functions to work can produce some fascinating results. Try our demonstration.

The curves which seem to occur most frequently in the teaching of sciences are those which are based on the sine and cosine functions. They are therefore a good example of how to build up the graph of a complex function from a program to draw the simplest versions. In this article we shall take the process step by step, adjusting the program to use the screen most effectively in developing the curves from Y=sin(x) to Y=c sin(ax)+d cos(bx). MODE 1 is used so that colour is available to use when helpful.

THE SIMPLE CURVE

One cycle of a sine or cosine curve requires a horizontal scale which runs from 0 to 360 degrees. The alternative scale would be from −180 to +180 degrees, but this does not give such an easily understood graph when more than one cycle is required. For that reason this program will not use negative angles.

On the vertical axis, the numerical values required are from −1 to +1, so that a large scale can be used.

The scales used are 1 degree = 3 points and 1 unit = 400 points on the graphic screen. Placing the origin of coordinates at the screen position (100,600) allows space to put the scales on both axes and leaves a space at the bottom of the screen in which to put the equation of the curve. (see figure 1)

INCREASING the NUMBER of CYCLES

CY is used throughout the remainder of the program for the number of cycles required.

Only 5 lines need to be added or amended to enable the program to produce any number of repeats of the curve. A limitation *HAS* been imposed, of 4 CYCLES, to keep the curve on the screen at reasonable clarity. (See Figure 2 and Program Listing 7)

MULTIPLE of ANGLE, e.g. sin(ax) or cos(bx)

One repeat of the curve sin(ax) will require only 360/a degrees. So that CY repeats will require T to be multiplied by CY/a. Two lines need altering, and five new lines are needed. (Program listing

The GENERAL CURVE v = csin(ax) + dcos(bx)

The multiplying factors c and d mean that the vertical axis must include more values to cover the possible maximum and minimum values. The maximum value is taken as c+d, which is a simple change to make, with the minimum value then being −c−d.

The program draws, on the same axes, the curves y=csin(ax), y=dcos(bx) and y=csin(ax)+dcos(bx), using the colours red, yellow and white respectively to distinguish between them.

The main program is rewritten (see lines 10-100 in Program Listing 9). The other main alteration is that PROCchoice has been rewritten to make it a simple question and answer section. (Lines 1600,1690)

PROCsincos is similar in form to PROCsin but includes both parts of the curve. (Lines 1800,1860)

The changes to the vertical scale mean that 1 is now equal to 400/(c+d). This leads to the fact that the sine function (line 1330) must be multiplied by c/(c+d), while the cosine function (line 1530) has to be multiplied by d/(c+d), with similar values incuded in line 1830.

The other changed factor in the calculations is that due to the combination of a and b. The graph of sin(ax) completes one cycle in 360/b degrees. To find the number of degrees in which one cycle of the combined curve is completed, PROClcm finds the smallest multiple (L) both 360/a and 360/b. (Lines 1890,1950)

The complete program will allow all the possible combinations of sine and cosine curves (within the limits of the screen! There is one possible amendment, according to the use which is made of the program: Radians could have been used instead of degrees. The following amendments would need to be made:

1. A symbol for PI and one for a radian defined in PROCsymbols.
2. Lines 1200-1210 should be altered so that the scales on the axes are in radians.

If values of T are changed so that 2*PI is used instead of 360, then the trigonometric functions must be simplified, because the RAD function will no longer be required.

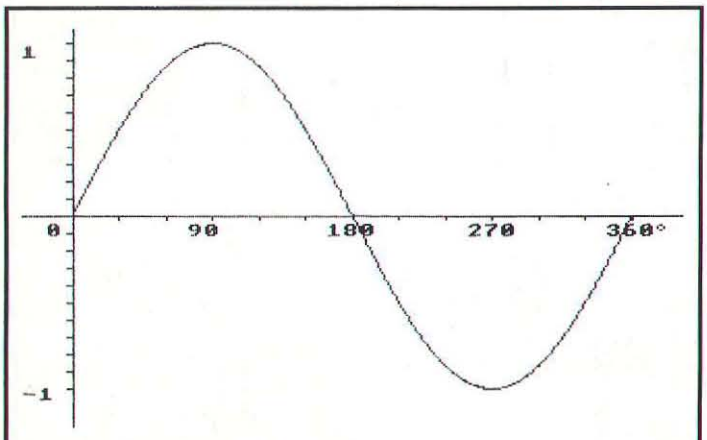


Fig. 1.

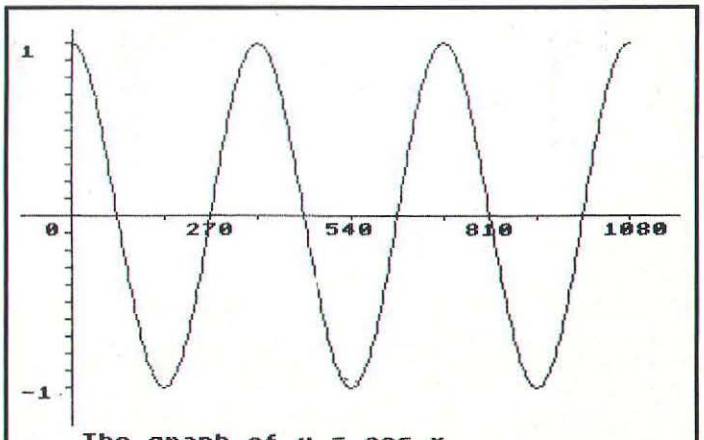
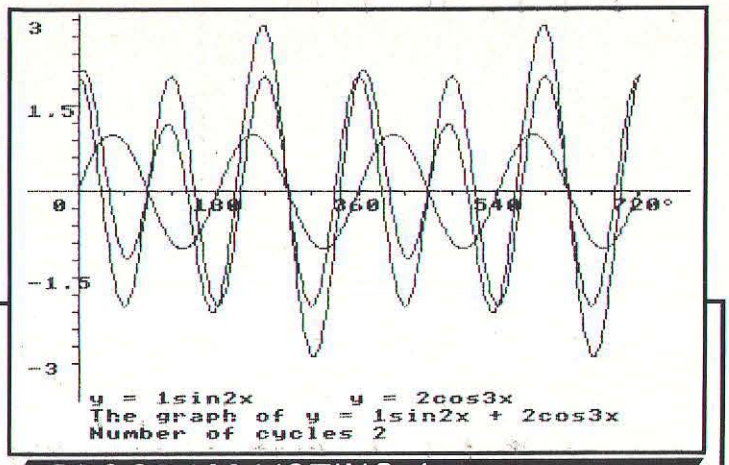


Fig. 2.



PROCsymbols
1010 CHR$230 is a small circle for degrees.

PROCaxes(Program Listing 1)
1110-1120 Draw the axes.
1130-1150 Mark the horizontal axes at 30 degree intervals.
1160-1180 Mark the vertical axes at intervals of 0.1
1190-1230 VDU5 joins the cursors together so that scales may be added.
1240 VDU4 separates the cursors again.

PROCsine(Program Listing 2)
1310 Move to the first point of the curve.
1320 Using T as the variable, taking values at intervals of 2 degrees.
1330 The horizontal position is 3*number of degrees, + 100. The vertical position is 400*the sine of the radian value of T.
1340 Draw to the next point.

PROCtitle(Program listing 3)
1410-1420 Places the equation of the function as F$ at the foot of the screen, F$ being defined in the main program.

PROCcosine(Program Listing 4)
The plotting of a cosine curve follows the same routine as the sine curve, so that the program, may as well give both options.

PROCchoice(Program Listing 5)
1610-1360 The choice of sine or cosine curves, SC being the variable.
1640 Checks that SC is either 1 or 2 by one of several methods of checking input values.

MAIN PROGRAM (Program Listing 6)
20 Defines any symbols and chooses which curve.
30-40 Draws a sine curve and makes F$ = "sin x".
50-60 Draws a cosine curve and makes F$ = "cos x".
70 Adds the title.

1210 Multiples the value of T by CY, so that the axis now shows the number of degrees required to complete the cycles required.
1330 Multiplies the value of T by CY for plotting purposes.
1530 as 1330
1650 Asks for the required value of CY.
1660 Checks that CY is an integer not greater than 4. (Notice alternative method of checking to method of 1620.)
1690 New position for ENDPROC

1330 The angle is amended to T*a for the sine curve.
1530 The angle is amended to T*b for the cosine curve.
1670-1700 ask for the values of a or b and alter CY as required.

PROGRAM LISTING 1

```
1000 DEFPROCsymbols
1010 VDU23,230,96,144,144,96,0,0,0,0
1050 ENDPROC
1100 DEFPROCaxes
1110 MOVE0,590:DRAW1279,590
1120 MOVE100,100:DRAW100,1023
1130 FOR T=0 TO 360 STEP 30
1140   MOVE 100+T*3,580:DRAW 100+T*3,590
1150   NEXT
1160 FOR F=-1 TO 1.1 STEP .1
1170   MOVE90,590+400*F:DRAW100,590+400*F
1180   NEXT
1190 VDU5:MOVE0,980:PRINT;"1":MOVE0,190:PRINT;"-1"
1200 FOR T=0 TO 360 STEP 90
1210   MOVE 50+T*3,570:PRINT;T
1220   NEXT
1230 MOVE 1230,570:PRINT;CHR$230
1240 VDU4
1260 ENDPROC
```

PROGRAM LISTING 2

```
1300 DEFPROCsine
1310 MOVE100,600
1320 FOR T=0 TO 360
1330   X=100+3*T:Y=590+400*SIN(RAD(T))
1340   DRAWX,Y
1350   NEXT
1360 ENDPROC
```

PROGRAM LISTING 3

```
1400 DEFPROCtitle
1410 VDU5:MOVE120,40
1420 PRINT;"The graph of y = ";F$
1430  ENDPROC
```

PROGRAM LISTING 4

```
1500 DEFPROCcosine
1510 MOVE100,1000
1520 FOR T=0 TO 360
1530   X=100+3*T:Y=590+400*COS(RAD(T))
1540   DRAWX,Y
1550   NEXT
1560 ENDPROC
```

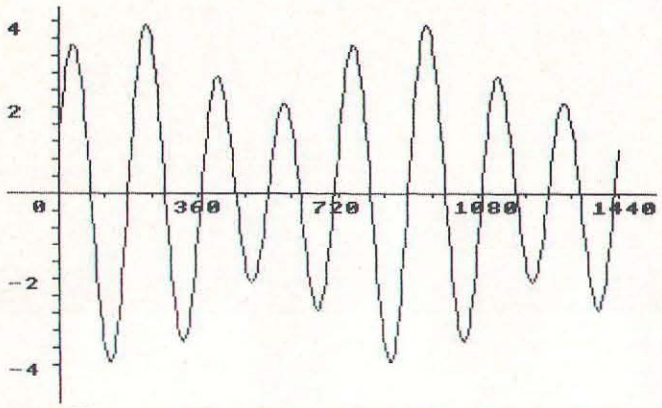
PROGRAM LISTING 5

```
1600 DEFPROCchoice
1610 CLS:PRINT"Which curve? Type"
1620 PRINT"  1.   for sine curve"
1630 PRINT"  2.   for cosine curve"
1640 INPUT SC:IF(SC-1)*(SC-2)<>0 THEN 1640
1650  ENDPROC
```

PROGRAM LISTING 6

```
 10 MODE 1
 20 PROCsymbols:PROCchoice:ON SC GOTO 30,50
 30 CLS:PROCaxes:PROCsine
 40  F$="sin x":GOTO 70
 50 CLS:PROCaxes:PROCcosine
 60  F$="cos x"
 70 PROCtitle
100 END
```

CONTINUED OVER



PROGRAM LISTING 7

```
 1210 MOVE 50+T*3,570:PRINT;T*CY
 1330 X=100+3*T:Y=590+400*SIN(RAD(T*CY))
 1530 X=100+3*T:Y=590+400*COS(RAD(T*CY))
 1650  PRINT''"How many cycles?(integer not greater
than 4"
 1660  INPUT CY:IF INT(CY)<CY OR CY<0 OR CY>4 THEN 1660
 1690  ENDPROC
```

PROGRAM LISTING 8

```
1330 X=100+3*T:Y=590+400*SIN(RAD(T*CY*a))
1530 X=100+3*T:Y=590+400*COS(RAD(T*CY*b))
1670 IF SC=2 THEN 1700 ELSE 1680
1680 PRINT''"In the curve y=sin(ax), a=?"
1690 INPUT a:CY=CY/a:GOTO 1720
1700 PRINT''"In the curve y=cos(bx), b=?"
1710 INPUT b :CY=CY/b:GOTO 1720
1720  ENDPROC
```

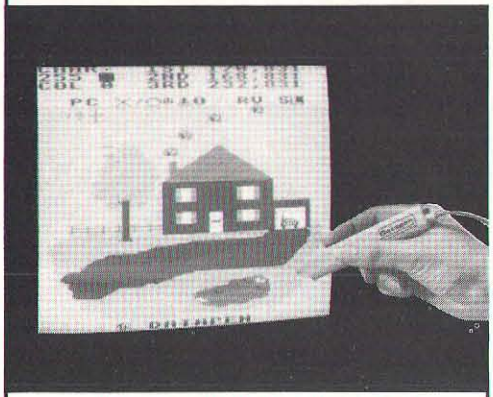
PROGRAM LISTING 9

```
   10 MODE 1
   20 PROCsymbols:PROCchoice
   30 GCOL0,3:CLS:PROCaxes
   40 GCOL0,1:PROCsine
   50 GCOL0,2:m=d:PROCcosine
   60 GCOL0,3:PROCsincos
   70 PROCtitle
   90  REM....G.W.GALLAGHER....1983
  100 END
 1000 DEFPROCsymbols
 1010 VDU23,230,96,144,144,96,0,0,0,0
 1050 ENDPROC
 1100 DEFPROCaxes
 1110 MOVE0,590:DRAW1279,590
 1120 MOVE100,100:DRAW100,1023
 1130 FOR T=0 TO 360 STEP 30
 1140   MOVE 100+T*3,580:DRAW 100+T*3,590
 1150   NEXT
 1160 FOR F=-1TO 1.1 STEP .1
 1170   MOVE90,590+400*F:DRAW100,590+400*F
 1180   NEXT:e=(c+d)/2:e=INT(e*10)/10
 1190 VDU5:MOVE0,980:PRINT;c+d:MOVE0,190:PRINT;-c-d:MOV
E0,790:PRINT;e:MOVE0,390:PRINT;-e
 1200 FOR T=0 TO 360 STEP 90
 1210   MOVE 50+T*3,570:PRINT;T*CY
 1220   NEXT
 1230 MOVE 1230,570:PRINT;CHR$230
 1240 VDU4
 1260 ENDPROC
 1300 DEFPROCsine
 1310 MOVE100,600
 1320 FOR T=0 TO 360
 1330   X=100+3*T:Y=590+c/(c+d)*400*SIN(RAD(T*CY*a))
 1340   DRAWX,Y
 1350   NEXT
 1360 VDU5:MOVE120,120:PRINT;"y = ";c;"sin";a;"x":VDU4

 1370  ENDPROC
 1400 DEFPROCtitle
 1410 VDU5:MOVE120,80:PRINT;"The graph of y = ";c;"sin"
;a;"x + ";d;"cos";b;"x"
 1420 MOVE120,40:PRINT;"Number of cycles ";CYC
 1440  VDU4
 1450  ENDPROC
 1500 DEFPROCcosine
 1510 MOVE100,1000
 1520 FOR T=0 TO 360
 1530   X=100+3*T:Y=590+d/(c+d)*400*COS(RAD(T*CY*b))
 1540   DRAWX,Y
 1550   NEXT
 1560 VDU5:MOVE620,120:PRINT;"y = ";d;"cos";b;"x":VDU4

 1570 ENDPROC
 1600 DEFPROCchoice
 1610 PRINT''"In the curve y=csin(ax)+dcos(bx)"
 1620  PRINT'"The value of a is?":INPUT a
 1630  PRINT'"The value of b is?":INPUT b
 1640  PRINT'"The value of c is?":INPUT c
 1650  PRINT'"The value of d is?":INPUT d
 1660 PROClcm
 1670  PRINT'"How many cycles?":INPUT CYC
 1680  CY=CYC*L
 1690  ENDPROC
 1800 DEFPROCsincos
 1810 MOVE100,590+d/(c+d)*400
 1820 FOR T=0 TO 360
 1830   X=100+3*T:Y=590+c/(c+d)*400*SIN(RAD(T*CY*a))+d/
(c+d)*400*COS(RAD(T*CY*b))
 1840   DRAWX,Y
 1850   NEXT
 1860 ENDPROC
 1890  DEFPROClcm
 1900 R=1:A=360/a:B=360/b
 1910 L=R*A/B
 1920 IF INT(L)=L THEN 1940 ELSE 1930
 1930  R=R+1:GOTO 1910
 1940  L=R*A/360
 1950  ENDPROC
```

Datapen BBC Lightpen Programs Datapen



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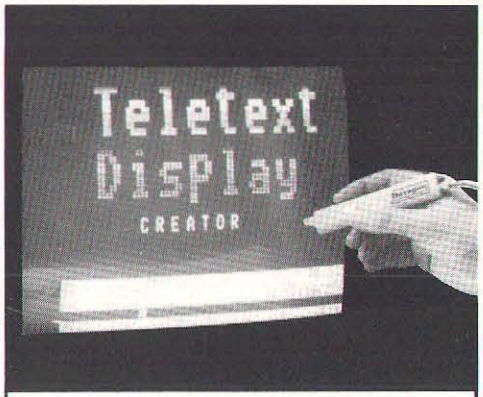

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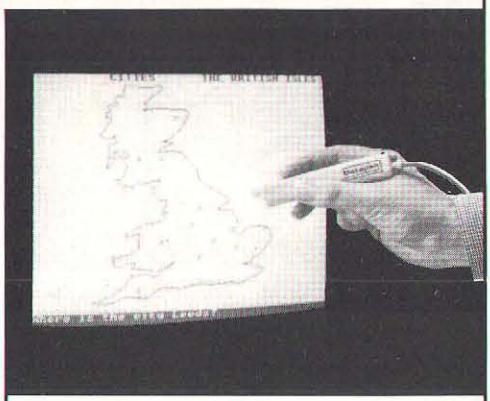

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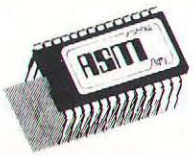

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In The Beginning

G.W. Gallagher

Further refinements to the administration file.

In this section, we deal with two uses of the administration file now set up. In the first place, an addition to the 'listing' program to produce lists in alphabetical order, and, secondly, a program to make the amendments which become necessary over a school year.

ALPHABETICAL LISTS

The listing program worked directly from the disc file, printing out a record as it was found. Unless the original file was in alphabetical order (which is almost an impossibility!), the records will need to be stored in an array before they can be re-ordered.

The size of the array is the limiting factor. If a list of more than about 250 names is to be stored, there may be memory space difficulties. Most of the lists required will be well under that length, and should cause no problems. The lines given here are in reference to the program in the last article.

There are many articles written on sorting methods, but the simplest way seems to be quite adequate here, as well as being the easiest to put into action. The method depends only on the numerical value of each letter. Thus ABC has a smaller value than ABD, which gives an easy way of checking one name against another. I have used the first four letters of the surname, i.e., if the record is A$, the part checked is MID$(A$,5,4). This will not for example separate all the SMITHs into alphabetical order amongt themselves. Changing the '4' of the MID$ function wil bring the amount of accuracy required. The additions to the original program are: (see Listing 1)

100 Set up an array LST$ to take 150 names
210 GOTO 700 instead of 110
260 GOTO 700 instead of 110
330 GOTO 700 instead of 110
380 GOTO 700 instead of 110
490 GOTO 700 instead of 110
620 GOTO 700 instead of 100
700 Ask if alphabetical order is required
710-730 deal with the response
740 go to PROCalphabetical to carry out the ordering
750 clear the array for another list
1860-1890 PROCarray, to clear the array
2155 adds the statement to store the record in the array.
2270 store the record in the array
2400 store the record in the array
2530 store the record in the array
3030 store the record in the array
3280 store the record in the array

PROCalphabetical (3400-3540) (listing 2)
3405 introduce the variable CHANGE which wil become 1 if a change in order has been made during the run of the loop.
3410 begin the loop
3420 check the first 4 letters of the name of the Jth record against the first 4 letters of the next record. If the first has a great value than the second they must be interchanged. Otherwise move on to the next pair.
3430 store the Jth record in TEMP$, and move the J+1th record into the Jth position
3440 place TEMP$ into the J+1th slot.
3450 put CHANGE=1 because a change has taken place.
3480 end of loop.
3490 If CHANGE=0 then no changes have taken place during the run of the loop, and the list is ready for printing, otherwise repeat the loop.
3500-3530 print roll number, form reference, name for each record in the array.

AMENDMENTS TO THE FILE

When the subjects being taken need to be changed in the record, the facility to do this is already available in the second program. When subjects are added in that program, any already included are deleted, so that a complete new set is added.

For the rest of the amendments likely to be needed, they fall into two groups. During the academic year pupils leave, or change forms, or even change surnames. I have myself been guilty of getting the sex of a new pupil wrong, when the name on a list contained a forename which was not helpful! Thus any of the pieces of information stored in the file may need to be amended.

The other main need is to be able to make large scale changes at the end of a year, when classes change, new intake has to be added, and a whole year at the top of the school has to be deleted. At this point, it is necessary to transfer pupils to a new file for the next year, when they are remaining in the school, without including those pupils who have left.

The file which replaces 'List84' has been taken to be 'List85'. As before, if the name you wish to use is included in the program, it will avoid the necessity to type in the name of the file every time the program is run.

The variable NY is used to indicate whether a new file is being made. If NY=0, then the new file process is NOT in operation. Records are offered for amendment in every detail except the subjects, and each record is returned to the same place in the original file after amendment. Cancelling a record means that the form reference is replaced by 'ZZZZ', so that even if a pupil has left, his/her details are still in the file for that year, but will not appear on any list except one which asks for the form reference 'ZZZZ'.

If NY=1, records are offered for amendment by form reference. When amendments have been made as detailed above, or if no amendment is required, the record is then placed in the new file at the next position available. 'Cancelling' a record in this case means that it is left unchanged in the old file, but NOT added to the new file.

CONTINUED OVER

THE PROCS USED

PROCWAIT	(1000-1030) waits for the space bar to be pressed
PROCwhich	(1400-1480) replaces the various parts of the string A$ by variable S1$ to S7$. (listing 3)
PROCexchange	(1490-1500) The unwanted part of the string is exchanged for its replacement. (listing 4)
PROCform(N$)	(1800-1850) makes sure that the form reference is in a recognisable format. (listing 5) PROCsearch (2930-3060) The file is opened to look for a particular reference at a particular position in the string. The variables A and B, sent from the main program, fix the position and length of the section to be checked, and N$ is the reference against which the check is to be made. When the end of the file is reached, the variable F is given the value 1. (listing 6)
PROCchange	(3100-3290) offers the various sections of the string for amendment. The variable 'choice' is used for the number of the section to be altered. What happens to the amended string depends on the value of NY as described above. In placing a record in the new file, a variable 'newnum' is introduced to count the records in the file. (listing 7)
PROCreplace	(3300-3360) The amended record is placed back in the file, using the counting variable I which has been carried forward form PROCsearch. (listing 8)
PROCnewplace	(3400-3460) The amended record is placed in the new file, using the variable 'newnum' which is the number of records in the new file. (listing 9)
PROCnewfile	(3470-3500) Opens the new file for the first time. (listing 10)
PROCnewrecords	(3510-3550) Once the new file is opened, each time it is to be used, this PROC looks to see how many records are already there, so that 'newnum' may be given its current value. (listing 11)

THE MAIN PROGRAM

(listing 12)

10-30	ask whether this is an 'annual' change, i.e. is a new file involved?
40-55	If a new file is involved, is it already opened?
60	Looks at a new file already opened to find the current value of 'newnum'.
70	Opens the new file for the first time, and puts 'newnum' =0.
100-420	This is the process when the annual change is not being made. A single record or the records for a complete form may be called up to be inspected, and amended where necessary. A single record is looked for by name, but it is not necessary to input the complete name, as long as the reference given matches the beginning of the surname. The values of A,B and N$ are decided by the choice of name or form reference. If a particular record is not found, then a message on the screen will say so.
500-620	in this section, the variable NY has the value 1, so that all amended records which are required are transferred to the new file.

DISC MENU

It was my intention to include in a later article a description of a program to write a !BOOT program to provide a menu of the set of Administration programs. However the article by Dave Carlos which was published in the March/April issue of ***A&B Computing*** does this very well, providing an attractive colourful menu for the programs. Since it can be added to a disc before the set of programs is complete, I suggest that the program should be used at this stage.

For my own programs, I use a single disc drive, and the simplest possible instructions to SAVE each program. This means that line 550 had to be altered to read: 550 IF answer% = 67 CHAIN file$(reply%) ELSE CLS:PROCmenu. This alteration still leads to the statement 'may not be BASIC' for all programs, needing an extra step to load the program required. If all programs on the disc are written in BASIC, the following simplification will provide the necessary loading facility: 1. Delete 420-560, i.e. DEFPROCcheck. 2. Amend 390 to read 390 CHAIN file$(reply%).

The menu then lists the programs under the titles saved, so that it would be helpful if the titles hinted at the use of the program, as a reminder! When using the *OPT4,3 will be found to be all that is needed in this particular situation. Pressing BREAK and SHIFT at the same time will then bring the MENU onto the screen.

PROGRAM LISTING 1

```
100DIM LST$(150)
210PROCWAIT:title$="MALE STUDENTS":GOTO 700
260PROCWAIT:title$="FEMALE STUDENTS":GOTO 700
330PROCWAIT:title$=feeder$:GOTO 700
380PROCWAIT:title$=catch$:GOTO 700
490PROCWAIT:title$=S$:GOTO 700
620PROCWAIT:title$=D$+G$+A$
700PRINT?"Alphabetical list?(Y/N)":INPUTN$
710IF N$="N" OR N$="n" THEN 110
720IF N$="Y" OR N$="y" THEN 740
730 GOTO 700
740PRINTtitle$: PROCalphabetical:PROCWAIT
760PROCarray:GOTO 110
900 END
1860DEFPROCarray
1870FOR I=0 TO 150
1880LST$(I)=""
1890NEXT
1900ENDPROC
2155number=number+1:LST$(number)=A$
2270number=number+1:LST$(number)=A$
2400number=number+1:LST$(number)=A$
2530number=number+1:LST$(number)=A$
3030number=number+1:LST$(number)=A$
3280number=number+1:LST$(number)=A$
```

PROGRAM LISTING 2

```
3400 DEFPROCalphabetical
3405 CHANGE=0
3410 FOR J=1 TO number-1
3420    IF MID$(LST$(J),5,4)>MID$(LST$(J+1),5,4) THEN 3
430 ELSE 3480
3430    TEMP$=LST$(J):LST$(J)=LST$(J+1)
3440    LST$(J+1)=TEMP$
```

```
 3450    CHANGE=1
 3480    NEXT
 3490 IF CHANGE=0 THEN 3500 ELSE 3405
 3500 FOR  J=1 TO number
 3510    PRINT;LEFT$(LST$(J),4);TAB(6);MID$(LST$(J),38,4
)TAB(12)MID$(LST$(J),5,24)
 3530    NEXT
 3540 ENDPROC
```

PROGRAM LISTING 3

```
1400 DEFPROCwhich
1410 S1$=LEFT$(A$,4)
1420 S2$=MID$(A$,5,24)
1430 S3$=MID$(A$,29,1)
1440 S4$=MID$(A$,30,6)
1450 S5$=MID$(A$,36,1)
1460 S6$=MID$(A$,37,1)
1470 S7$=MID$(A$,38,4)
1480 ENDPROC
```

PROGRAM LISTING 4

```
 1490 DEFPROCexchange
 1500  L=LEN(A$)
 1510  ON choice GOTO 1520,1530,1540,1550,1560,1570,158
0,1580
 1520 A$=S$+RIGHT$(A$,L-4)
 1530 A$=LEFT$(A$,4)+S$+RIGHT$(A$,L-28):GOTO 1600
 1540 A$=LEFT$(A$,28)+S$+RIGHT$(A$,L-29):GOTO 1600
 1550 A$=LEFT$(A$,29)+S$+RIGHT$(A$,L-35):GOTO 1600
 1560 A$=LEFT$(A$,35)+S$+RIGHT$(A$,L-36):GOTO 1600
 1570 A$=LEFT$(A$,36)+S$+RIGHT$(A$,L-37):GOTO 1600
 1580 A$=LEFT$(A$,37)+S$+RIGHT$(A$,L-41):GOTO 1600
 1600 ENDPROC
```

PROGRAM LISTING 5

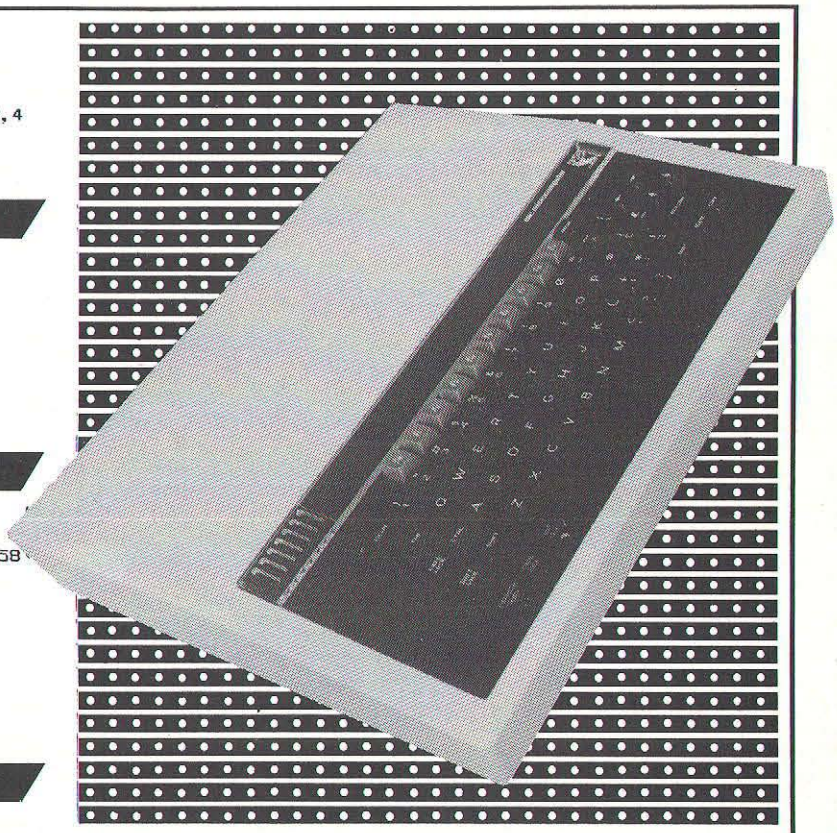
```
 1800 DEFPROCform(N$)
 1810 IF LEN(N$)>3 THEN N$=LEFT$(N$,4):GOTO 1850
 1820 IF LEN(N$)>2 THEN N$=LEFT$(N$,1)+" "+RIGHT$(N$,2)
:GOTO 1850
 1830 IF LEN(N$)>1 THEN N$=LEFT$(N$,1)+"  "+RIGHT$(N$,1
):GOTO 1850
 1840 N$=N$+"    "
 1850 ENDPROC
```

PROGRAM LISTING 6

```
2930 DEFPROCsearch
2940 X=OPENIN("List84")
2960 PX=(I-1)*70
2970 PTR#X=PX
2980 INPUT#X,A$
2990 IF MID$(A$,A,B)<>N$THEN 3030
3000  GOTO 3060
3030 I=I+1
3040 PX=PX+70
3045 IF PX>EXT#X THEN 3050 ELSE 2970
3050 F=1
3060 CLOSE#X
3070 ENDPROC
```

PROGRAM LISTING 7

```
3100 DEFPROCchange
3110 CLS:PROCwhich
3120 PRINT'"Which number?"
3130 PRINT'"1  to change ";S1$
3140 PRINT'"2  to change ";S2$
3150 PRINT'"3  to change ";S3$
3160 PRINT'"4  to change ";S4$
3170 PRINT'"5  to change ";S5$
3180 PRINT'"6  to change ";S6$
3190 PRINT'"7  to change ";S7$
```



```
3200 PRINT'"8  to cancel"
3210 PRINT'"9  to leave unchanged"
3220  INPUT choice:IF choice =9 THEN 3280
3230 IF choice<8 THEN 3250 ELSE 3240
3240 IF NY=1 THEN 3290 ELSE S$="ZZZZ":GOTO 3270
3250 PRINT"PLease type in the correct entry.":INPUT S$
3260  IF choice=7 THEN PROCform(S$)
3270 PROCexchange:GOTO 3110
3280 IF NY=1 THEN 3286 ELSE 3282
3282 I=N:PROCreplace:GOTO 3290
3286 newnum=newnum+1:PROCnewplace
3290 ENDPROC
```

PROGRAM LISTING 8

```
3300 DEFPROCreplace
3310 X=OPENUP("List84")
3320 PX=(I-1)*70
3330 PTR#X=PX
3340 PRINT#X,A$
3350 CLOSE#X
3360 ENDPROC
```

PROGRAM LISTING 9

```
3400 DEFPROCnewplace
3410 X=OPENUP("List85")
3420 PX=(newnum-1)*70
3430 PTR#X=PX
3440 PRINT#X,A$
3445 PTR#X=PTR#X+70
3450 CLOSE#X
3460 ENDPROC
```

CONTINUED OVER

PROGRAM LISTING 10

```
3470 DEFPROCnewfile
3480 X=OPENOUT("List85")
3490 CLOSE#X
3500 ENDPROC
```

PROGRAM LISTING 11

```
3510 DEFPROCnewrecords
3520 X=OPENIN("List85")
3530  newnum=EXT#X DIV 70
3540 CLOSE#X
3550 ENDPROC
```

PROGRAM LISTING 12

```
   10 NY=0:CLS:PRINT''"Is this an annual record change?
(Y/N)"
   20 INPUT N$:IF N$="Y" OR N$="y" THEN 40
   30 IF N$="N" OR N$="n" THEN 100 ELSE 20
   40 NY=1:PRINT''"Have you already opened the new file
?   (Y/N)"
   50 INPUT N$:IF N$="Y" OR N$="y" THEN 60
   55 IF N$="N" OR N$="n" THEN 70 ELSE 50
   60 PROCnewrecords:PRINT''"There are ";newnum;" recor
ds in the new file.":PROCWAIT:GOTO 500
   70 PROCnewfile:newnum=0:GOTO 500
  100 CLS:F=0:PRINT''"Do you wish to amend "
  110 :PRINT''" 1.  a single record"
  120 :PRINT''" 2.  a form"
  125 :PRINT''" 3.  or end"
  130 INPUT C:IF(C-1)*(C-2)*(C-3)<>0 THEN 130
  140 IF C=3 THEN 900
  145 IF C=2 THEN 400 ELSE 150
  150 PRINT''"e.g.SMITH DAVID"
  160 PRINT''"What is the name?":INPUT N$
  170 LA=LEN(N$):A=5:B=LA:I=1:PROCsearch:IF F=1 THEN 90
0
  180 N=I:PROCchange:GOTO 100
  400 PRINT"Please give the form reference":INPUT N$:PR
OCform(N$):I=1
  410 A=38:B=4:PROCsearch:IF F=1 THEN 100
  420 N=I:PROCchange:I=N+1:GOTO 410
  500 F=0:CLS:PRINT''"The records will be presented a f
orm at a time,using the full form reference."
  510  PRINT'"Please give the form reference":INPUT N$:
PROCform(N$):I=1
  520 A=38:B=4:PROCsearch:IF F=1 THEN 600
  530 N=I:PROCchange:I=N+1:GOTO 520
  600 CLS:PRINT''"Do you wish to amend another form?(Y/
N)":INPUT N$
  610  IF N$="Y" OR N$="y" THEN 510
  620  IF N$="N" OR N$="n" THEN 900 else 600
  800 CLS:PRINT"The record cannot be found":PROCWAIT:GO
TO 100
  900  END
 1000 DEFPROCWAIT
 1010 PRINT''"Press the space bar to continue"
 1020 IF GET = 32 THEN 1030 ELSE 1020
 1030 ENDPROC
 1400 DEFPROCwhich
 1410 S1$=LEFT$(A$,4)
 1420 S2$=MID$(A$,5,24)
 1430 S3$=MID$(A$,29,1)
 1440 S4$=MID$(A$,30,6)
 1450 S5$=MID$(A$,36,1)
 1460 S6$=MID$(A$,37,1)
 1470 S7$=MID$(A$,38,4)
 1480 ENDPROC
 1490 DEFPROCexchange
 1500  L=LEN(A$)
 1510  ON choice GOTO 1520,1530,1540,1550,1560,1570,158
0,1580
 1520 A$=S$+RIGHT$(A$,L-4)
 1530 A$=LEFT$(A$,4)+S$+RIGHT$(A$,L-28):GOTO 1600
 1540 A$=LEFT$(A$,28)+S$+RIGHT$(A$,L-29):GOTO 1600
 1550 A$=LEFT$(A$,29)+S$+RIGHT$(A$,L-35):GOTO 1600
 1560 A$=LEFT$(A$,35)+S$+RIGHT$(A$,L-36):GOTO 1600
 1570 A$=LEFT$(A$,36)+S$+RIGHT$(A$,L-37):GOTO 1600
 1580 A$=LEFT$(A$,37)+S$+RIGHT$(A$,L-41):GOTO 1600
 1600 ENDPROC
 1800 DEFPROCform(N$)
 1810 IF LEN(N$)>3 THEN N$=LEFT$(N$,4):GOTO 1850
 1820 IF LEN(N$)>2 THEN N$=LEFT$(N$,1)+" "+RIGHT$(N$,2)
:GOTO 1850
 1830 IF LEN(N$)>1 THEN N$=LEFT$(N$,1)+"  "+RIGHT$(N$,1
):GOTO 1850
 1840 N$=N$+"   "
 1850 ENDPROC
 2930 DEFPROCsearch
 2940 X=OPENIN("List84")
 2960 PX=(I-1)*70
 2970 PTR#X=PX
 2980 INPUT#X,A$
 2990 IF MID$(A$,A,B)<>N$THEN 3030
 3000  GOTO 3060
 3030 I=I+1
 3040 PX=PX+70
 3045 IF PX>EXT#X THEN 3050 ELSE 2970
 3050 F=1
 3060 CLOSE#X
 3070 ENDPROC
 3100 DEFPROCchange
 3110 CLS:PROCwhich
 3120 PRINT'"Which number?"
 3130 PRINT'"1  to change ";S1$
 3140 PRINT'"2  to change ";S2$
 3150 PRINT'"3  to change ";S3$
 3160 PRINT'"4  to change ";S4$
 3170 PRINT'"5  to change ";S5$
 3180 PRINT'"6  to change ";S6$
 3190 PRINT'"7  to change ";S7$
 3200 PRINT'"8  to cancel"
 3210 PRINT'"9  to leave unchanged"
 3220  INPUT choice:IF choice =9 THEN 3280
 3230 IF choice<8 THEN 3250 ELSE 3240
 3240 IF NY=1 THEN 3290 ELSE S$="ZZZZ":GOTO 3270
 3250 PRINT"PLease type in the correct entry.":INPUT S$
 3260  IF choice=7 THEN PROCform(S$)
 3270 PROCexchange:GOTO 3110
 3280 IF NY=1 THEN 3286 ELSE 3282
 3282 I=N:PROCreplace:GOTO 3290
 3286 newnum=newnum+1:PROCnewplace
 3290 ENDPROC
 3300 DEFPROCreplace
 3310 X=OPENUP("List84")
 3320 PX=(I-1)*70
 3330 PTR#X=PX
 3340 PRINT#X,A$
 3350 CLOSE#X
 3360 ENDPROC
 3400 DEFPROCnewplace
 3410 X=OPENUP("List85")
 3420 PX=(newnum-1)*70
 3430 PTR#X=PX
 3440 PRINT#X,A$
 3445 PTR#X=PTR#X+70
 3450 CLOSE#X
 3460 ENDPROC
 3470 DEFPROCnewfile
 3480 X=OPENOUT("List85")
 3490 CLOSE#X
 3500 ENDPROC
 3510 DEFPROCnewrecords
 3520 X=OPENIN("List85")
 3530  newnum=EXT#X DIV 70
 3540 CLOSE#X
 3550 ENDPROC
```

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DISPLAY	80 characters by 25 lines	80 characters by 25 lines
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AB4

Bookshelf

Books on Programming Techniques for the BBC Micro. Do they deserve a place on your bookshelf? Multiple program books. Are they worth it?

Advanced Programming Techniques For the BBC Micro. by Jim McGregor and Alan Watt. Published by Addison-Wesley. Price: £7.95 for 376 pages.

Good old Addison-Wesley have released yet another book about the BBC Micro, as a second part to an earlier publication 'The BBC Micro Book...BASIC Sound and Graphics' There are few prerequisites to using this book other than a sound knowledge of the Manual, very little reference is made to the earlier book and should thus be suitable as an independant source of text other than the User Guide.

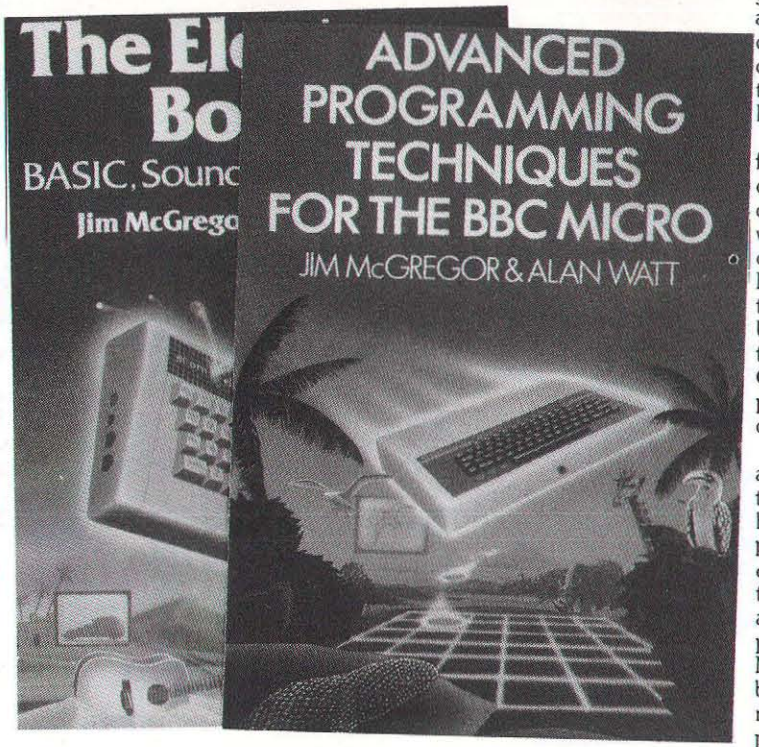
PRESENTATION AND CONTENT

Presentation is very important to a book such as this. A colourful cover depicts the BBC flying over a jungle with reference to certain projects found later in this book. It is itself not one of those publications which is a virtual re-write of the manual; it holds many examples, illustrations and projects to complete which may be suited as classwork although I feel that some of the exercises are just a little too difficult. It is really up to the teacher to decide which are suitable for use and which are not.

SELF CONTAINED

Each chapter is self contained and requires no reference to earlier or later chapters other than the Introduction, I found it enjoyable moving from chapter to chapter in this haphazard fashion giving the impression of one strolling about the insides of the computer, very nice.

'Advanced Programming Techniques...' sets out from the beginning to develop your programming style, it assumes that you have already mastered BBC BASIC and that you have developed a good knowledge of the BBC's operating system, this is an important prerequisite and it is stated quite clearly in the Preface. If you are unsure about your knowledge on any of the above, then the companion publication may be more useful.



One main advantage that 'Advanced Programming Techniques...' has is that each chapter is a separate tutorial on its own, the programming style is clearly geared towards structured programming (which you either love or hate) and leads to a beautifully ordered and structured synopsis of the PROCedures involved, in fact in all but one case PROCedures were used instead of GOTOs (and the latter proved unavoidable in the circumstances). If you do decide to read the book sequentially (ie chapter to chapter) then you are treated to a whole self contained course of tips, aids and projects which all individually highlight the features of programming the BBC in a manner which is both interesting and informative, the authors McGregor and Watt cleverly hold you interest by introducing a BASIC 'Space Invader' — type game and invite interaction and improvement throughout, making use of speed and memory saving devices which could be applied to just about any application you could think of in BASIC. There is some quite hefty use of mathematics in the third chapter which deals with matrix multiplication in order to perform a number of transformation on an object, again there are some very clear illustrations and these (alongside clear screen dumps) give very pleasing effects. The Math aspect increases when we begin to use wire frame drawings and hidden line removal (a classic problem which causes great confusion in other books) and it would be wise just having a quick browse over this chapter a couple of times before tackling the subject it you are a bit wooly headed when it comes to maths.

The book moves from wire frame graphics to animation. This chapter raises some points about computer aided learning and word animation alongside user — defined characters and even a Micro mouse project. This is certainly a better introduction to UDG's than the manual's but is this advanced programming? Certainly in the light of the other projects it isn't, but nevertheless it does raise some useful points.

'Advanced uses of sound' is a very useful chapter; it introduces not only the basics of harmony and tempo, but also applies this with relevent control over the hardware to achieve this. There are some useful algorithms here which tie into a project at the end of the chapter. Musical knowledge may be useful but it is certainly not expected as music terminology is clearly explained.

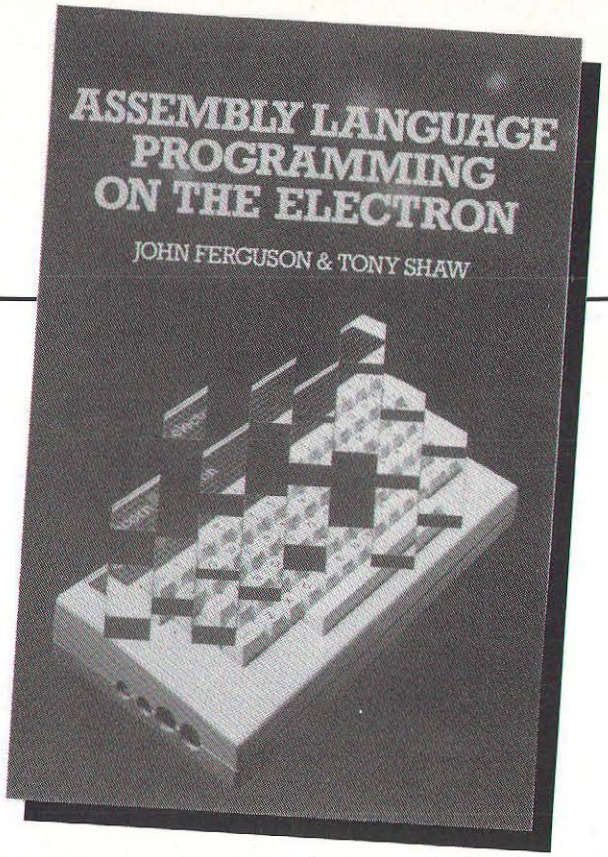
Probably the second most classic exercise is that of string searching and sorting, the book gives some very powerful algorithms for searches including simple exchange sorts and linear search routines. Really advanced methods such as binary chopping and direct access to subtables are also handled well although at this level, I feel that BASIC is totally unsuited for the purpose. This chapter leads on to the subject of recursion and culminates in graphic drawings of Sierpinski curves and it's variations. The age old 'Tower Of Hanoi' routine is given and solutions are sought interactively.

In a way the last two chapters lead on from this to introduce tree — branching and fundamentals of artificially intelligent games, which are exemplified in a series of exercises building up a 'Tic Tac Toe' style of game. The last chapter centres around a BASIC interpreted 'LOGO' language, whose listing is given in it's entirely (seperated for explanation purposes). The Book is finished off with five appendices, all of which are extensions of their relavent chapters but also include colour tables and an ASCII chart.

CONCLUSIONS

As a whole the book was delightfully easy to use and read, although I feel that the print quality lets it down somewhat, a shame because of the whole the examples are clear and concise with plenty of diagrams and illustrations where needed. The program listings were readable and thoroughly error free, obviously there has been great thought over the subject matter, providing a useful source text as a supplement to the User Guide since it centres around developing a conscious programming style and although the book retails at £7.95 it certainly represents good value for money and would be a useful extension to those who feel confident in branching out from simple programming.

On the teaching side, the book is a good and thorough series of lessons in advanced BASIC programming, there are exercises in which you can either interract or avoid, and each subject has at least one or two useful features. McGregor and Watt (the authors) have found an unfilled niche in an already overcrowded market, many of which are appallingly bad and centre around 'Getting Started'. 'Advanced Programming. . .' takes you far beyond that and invites the reader to stretch his brain and start thinking about problems which are made both painless and enjoyable which should make this book a must for any BBC owner and/or programmer.



Assembly Language Programming on the BBC Micro by John Ferguson and Tony Shaw. Published by Addison-Wesley, 200 pages. Price: £7.95.

Yet another book on assembly language and machine code? Yes, another one, but this one has been around for a several months, and if you are thinking of launching into machine code it could be a good investment.

The two authors have a clear and readable style, and overall the book has a sensible approach. The first two chapters are very useful, dealing with the essentials of how the computer and the microprocessor actually operate. Anyone who does decide to buy the book would be well advised to spend some time on then as they give valuable background that help enormously in getting a proper understanding of how machine code actually works. The explanation of machine code instructions in chapter two is exemplary.

The third chapter is in the same category, going thoroughly over the assembler. The authors than explain machine code subroutines, and introduce the two simplest operating subroutines straight away. This is unusual, but in my opinion a very good way to attack machine code programming, since it gives the beginner a feeling of power right away. Starting assembly language is frustrating enough without feeling you cannot even detect a key being pressed or write a character on the screen.

From there on, the book tackles everything one needs to know to begin programming, and covers all the mnemonics, even the rather obscure ones. There is an excellent section on where to put your assembled machine code, and a lot of diagrams and sample programs to help. The longer programs at the end of the book are genuinely useful as well as instructive.

As usual there are a few misprints and printers errors, some more serious than others. The example of two-pass assembly on page 66 of my copy was wrong, and would not work, but other misprints were relatively minor.

The section on the command line interpreter (page 49,50) could have been deferred till later, I felt, and perhaps the explanation of the stock preceding it as well. Otherwise the book is excellent, and beginners will particularly appreciate the good sample programs, including a most useful one to output VDU sequences by looped calls to OSWRCH (pages 73-75).

The book makes good use of a variety of typefaces, though one of these was bordering on the illegible on the rather cheap paper. But with a glossary as well as an index, an appendix summarising all the assembler mnemonics, and sections on using CALL and USR from BASIC, interrupts, the 1MHz bus, and the 6522 and 6850 chips, this is the kind of introductory book that can take the reader where he or she want to go — all the way to writing powerful machine code programs that really make use of a powerful machine.

Sixty Programs for the BBC Micro by Erskine & Humphrey Walwyn, Paul Stanley & Michael Bews. Published by Pan Books Ltd. Price: £4.95

Sixty programs to type in for a fiver? Doesn't sound too bad, does it. Pan Books and Personal Computer News have ganged up to produce this volume, packed with programs for the BBC. Some of the names will be familiar; the operation of some will seem familiar despite their names.

A few of the listings reveal themselves as conversions from other machines. There are lots of GOSUBs and GOTOs alongside the DEF FNs and *FX calls. The listings are accompanied by no documentation or explanation of how the program does whatever it does and the lack of structure can make programs awkward to follow. Some do have PROCs with meaningful names and this makes the path the programs follow much easier to trace. Still, these listings offer little to the novice programmer wishing to learn from his/her hours of typing in. Newcomers, I'm afraid, will end up with a workable program but little understanding.

Most of the programs are games of one sort or another although Morse Tutor, Critical Path Analysis, Numbers, Omnicalender and Biorhythms break the mould. Each program is preceded by a short explanation of what the finished product does and a bit of background to set the

CONTINUED OVER

imagination going and encourage the typing in of what can be up to eight pages of listing. All game-playing or input instructions reside within the programs themselves. The listings are excellently reproduced (except for a few smudged $ signs). They all come from the original printed listings. The introduction assures the buyer that all the programs have been exhaustingly tested so there should be no problems when correctly typed in.

Looking at the games themselves confirmed my fears about the graphics and sound of the programs. Buzzy Bee turned out to be quite fun. A little bird runs about the bottom of the screen pecking away at the stems of a row of plants. If any of the plants should reach the top then the bee drops down, takes the nectar and you have lost. You are told how long you survived and there is a hi-score. The user-defined characters are average and there is an attempt at simulating the buzzing sound of the bee.

Sheep trial takes place on a deadly boring green baize background with single lines to delineate the field and pen. There are no sound effects and the four sheep and dog are miniscule. The cursor keys are used for controlling the rather jumpy movement of the dog and they are never easy to handle.

'Top' is a racing game which employs crude game-board graphics, a track created from text characters (a device necessary only on the smallest machines nowadays) and other features you do not buy a BBC Micro to enjoy. None of the error trapping is foolproof and Escape and Break keys are not disabled, at least in the programs I tried.

Making the Most of the Micro by Ian Trackman and Henry Budgett. Published by BBC Publications. Price: £12.95 for 95 pages and 31 programs.

Is it a book or is it software? It doesn't even come under the new category of Bookware. In fact whatever category Making the Most falls into, there is no doubt that the BBC do an excellent job backing up their television series, part of the ambitious Computer Literacy scheme. they must take some of the credit for the high number of home computers per head of population in this country. There are so many micros being made that we even have a chip shortage.

Making the Most (book and tape) takes its themes from topics covered in the recently repeated series (and available on video in America). The idea is to explain some of the more advanced aspects of microcomputers through simple programming demonstrations often combining a real world simulation with tutorial on programming technique. The aims of Ian Trackman and Henry Budgett in emphasising the necessity for structured programming are admirable and not always appreciated by computer buffs. Chapter One, on programming style, gives us an example of bad programming, of the 'good' alternative and a third called KLUDGE. KLUDGE looks a bit like a program but is in fact a program plan in plain English, a stage that the authors recommend every program should go through.

Chapters on simple graphics and artificial intelligence are good introductions to the subjects, although many Beeb owners will have been through this country before Reference is made to the BBC Buggy which was featured in the television series and a demo program is on the tape which can be easily converted to actually control the robot.

The advanced graphics content of the chapter thus designated consist mainly of exercises in colour switching. The most sophisticated of these turned out to be the old favourite of spherical motion. SOme rather colourful planets don't make the point as effectively as they might. The wire frame house is fun to play with, homing in, rotating and removing hidden lines. The utilities are standard except for Titles, which is the caption generator used in the television series. When it's finished you sit for a while waiting for he farming programme to come on.

The most impressive section of this guide to computing is the last, a selection of simulations, graphically (and aurally) demonstrating various operations which the home computer carries out evey time you switch on, but which remain a complete mystery to most micro owners. Numbered among these are cassette loading and saving (how the information is stored and retrieved) and analogue to digital conversion. this latter should suggest that the book is geared towards the BBC Micro and that is indeed so. Lucky Beeb owners to have the benefit of a large Corporation behind them.

Making the Most of the Micro is an excellent package, attractively put together and a useful product, especially for those new to the computing game.

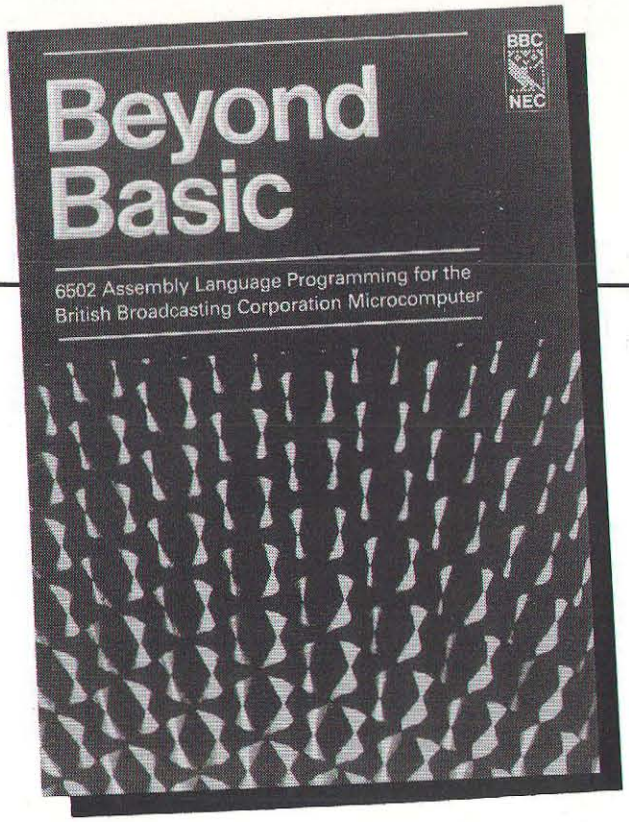
Beyond Basic by Richard Freeman. Published by BBC Publications. Price: £7.95 (book), £11.50 (cassette).

There are a number of books currently on the market designed to teach people how to program their computer in machine code. Users of the BBC Microcomputer have a large advantage by having an assembler built into their operating system. This book, subtitled '6502 Assembly Language on the British Broadcasting Corporation Microcomputer', is the first of such books to be published by the BBC.

Its stated aim is to help people who already have a good grasp of BASIC to move onto assembly language programming. It approaches the subject slowly, gently easing the novice into the world of hex, the stack, and registers. The book is organised into ten chapters, which chooses to call units. The reader is introduced to number representations, addition and subtraction, and jumps, loops and branches, through to the more complex issues of addressing modes, multiplication and division, and lists and tables. The final group of units cover the stack, CALL, USR and masking, and the BBC operating system calls, and a unit entitled 'tough stuff', which covers 16 bit manipulations and sorting a basic array. The tenth unit is a round-up and deals with placing programs and data in memory, programming errors and style, and saving of machine code. Three appendices cover the BBC microcomputer character set, the 6502 instruction set, and a few titles for further reading.

The success of the book has to be judged against its stated intentions. It is aimed at people who have a good grasp of BASIC; it offers a problem solving approach to assembly language not a plod through the instruction set; and it is aimed specifically at the BBC microcomputer not generally at 6502 systems.

That the reader needs to have a good grasp of BASIC is not obvious. Basic terms are used often without reference or ex-



planation, but those that have particular use with assembler, like the use of the DIM statement to reserve memory, are highlighted. In these cases they are literally highlighted by using green text instead of black. Only in the latter part of the book would a learner at BASIC begin to struggle, but this is more a mark of the gentle approach than an attempt to cater for the novice.

The book certainly is not a plod through the instruciton set. In fact there are too many commands not used in this book for my liking. In the listing of the instruction set in appendix 2, 13 commands out of a total of 56 are marked as not being included in the book. These include use of the decimal mode and interupts.

This last point is of relevance when assessed against the final statement of intent, that this is specifically a book for the BBC microcomputer. For the book to dedicte a mere 19 pages to operating system calls is a pity. One is continually told by Acorn to use all the proper routes through the system instead of cutting corners that might prevent the correct operation of programs with later operating systems. I would have liked to see much more subject matter in this very important area.

In total the book gives an excellent introduction into the world of assembly language programming. Its most obvious target will be those people who are complete learners. Anyone who has already got to grips with another assembly language might find the gentle approach a little laboured and drawn out. My biggest disappointment was to see no information on graphics. One of the most common reasons for turning to assembly language is to speed up games. This invariably involves the display and movement of graphical forms. This is not mentioned anywhere in this book.

Accompanying the book is a cassette which contains all the programs listed in the text. One of the best ways to learn assembly language is to get on a keyboard and type some in. To simply download from cassette is a shortcut that I would not recommend, and at the exorbitant price of over £11, represents a significant saving by just buting the book. This I can recommend.

The BBC Micro Compendium by Jeremy Ruston. Published by Interface Publications. Price: £14.95 for 547 pages.

This is a large tome from a prolific writer on the BBC computer. It numbers some 547 pages and has 9 chapters. The first chapter is an introduction into assembly language programming and it covers most of the aspects of 6502 programming such as the registers, modes of addressing, and then goes on to introduce each command in the 6502 instruction set with a brief note on each. The second chapter covers arithmetic on the computer, explaining how simple numbers are stored and explains how to multiply them.

Chapter three covers boolean algebra (with a minor spelling mistake starting the second paragraph (f501p110s1120)) explaining AND,OR,EOR, and NOT and going on to show how the computer uses this in plotting graphics. Chapter four explains further on arithmetic showing how the computer stores floating point numbers. Chapter five is entitled "Evaluating expressions" and introduces the reader to reverse Polish notaton. It includes programs for evaluating reverse Polish calculations and converting between that and the normal algebraic form.

Chapters six and seven are about two seperate languages FROTH and SLUG. These are programs that allow the BBC computer to run programs in languages other than BBC BASIC without the need for more sideways ROMs. I would have liked to have seen more examples of programs for these languages than those that were printed. The last but one chapter is about an intelligent dissasembler that is used to dissasemble the BASIC ROM. The final chapter is an annotated dissasembly of the BASIC ROM and takes up more than three quarters of the book. At the end of most chapters is a "diversion", this is a program that is either an interesting graphic display or a useful utility.

Aside from a few minor printing errors this is a very good book that I would recommend it to anyone who had a good basic knowledge of assembly language programming and wanted to see what made their computer work.

BRAINTEASERS for the BBC and Electron Computers. by G Ludinski. Phoenix Publishing Associates. Price £5.95.

The good news is that 'Brainteasers' consists of 29, well structured programs of a typable length. Each has a section on programming hints that enable you to adapt the programs to fit your aptitude and requriements. Additionally, many programs display excellent working examples of features and procedures that the potential programmer ould find helpful eg. shape construction, time displays, hints upon memory requirement reduction.

"Whodunnit' includes an envelope statement that can be used to create sound effects whereas 'Detective' exhibits a procedure for animating figures. '3-D Brainstorm' is an innovative noughts and crosses game, and 'Name the Graph' takes the moil out of Algebra. The 'flagship' of the book however, is The Francis Drake adventure game which is advertised as 'the most ambitious, interesting and testing program in this book.' It is, by far.

The bad news is that the battle for the epithet 'Least ambitious, interesting and testing program' is a lot closer. The truth is, that a lot of the prorams transgress the eigth deadly sin of not really being worth the effort to type them into the computer. Still, if you are the sort of person that buys puzzle books, then this book would suit you admirably.

Electron Machine Code for Beginners by Ian Sinclair. Price: £6.95.

The Electron has one big advantage over the vast majority (if not all) comparable home computers and that is the inclusion of an assembler. There will come a time that most users will want to delve into the world of accumulators, X registers, Y registers, stacks and the many wonders of assembler programming. The reasons for this venture may be varied, be it in order to increase execution speed, to conserve precious RAM or just for the delight of learning the machine's inner workings. An introductory text is essential and this book by Ian Sinclair (where does he find the time to write all these books?) qualifies for consideration.

It is often the case that

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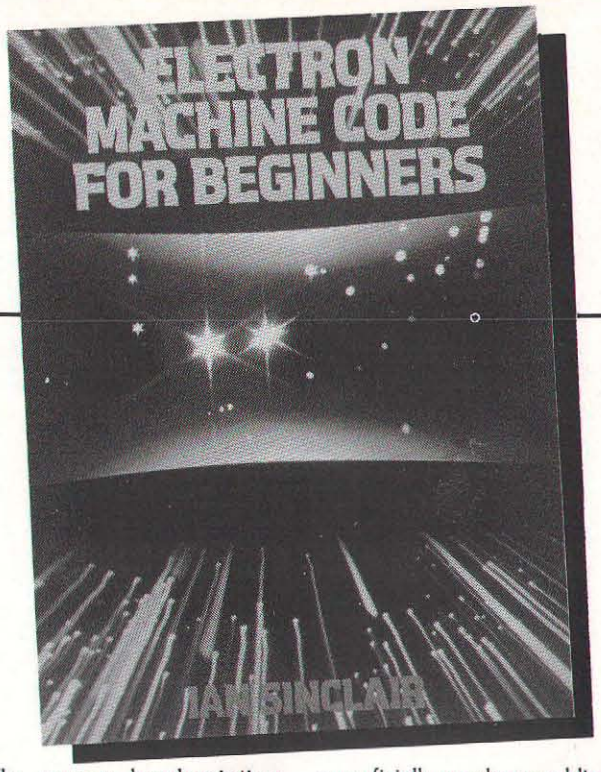


machine-code/assembler books for beginners pay only lip-service to the task of easing learners into the precise area of machine-code programming, falling into the trap of rushing on too quickly and trying to cover too much. Ian Sinclair has managed to give us a delightful book with the odd touch of humour, but with a lot of information, depending only on a reasonable knowledge of BASIC.

The book's opening chapters are priceless to novices in the field of computer innards. Sinclair takes the trouble to introduce the computer jargon (ROM, RAM, bit, byte, MPU, etc) continuing with an introduction to a block diagram of the Electron, considering the links between the ROM, RAM and MPU. Next to get the Sinclair treatment is BASIC and a very useful description of how keywords and variables are stored appears in chapter two. The blend of information and comprehensibility has been judged well and though covered in detail, these important topics do not bog down the reader.

The central chapters of the book give the meat of the information on assembler programming. Covered are topics such as hex, addressing methods, the PC, A, X, Y, S and P registers, the basic actions on them, flow-charting, calls to subroutines, very simple movement on sreen machine-code loading and saving. These topics are dealt with in a pleasant, readable manner, at all times encouraging the reader to follow the good example programs given. It's a shame that there are no suggested exercises since I'm sure that beginners reading this book need guidance in developing teh basic skills covered and as such short exercises would have proved invaluable.

The book's finishing chapters look at the problems involved with debugging programs. Unusually, Sinclair goes into the details of a commercially availablt took, ORBIT's EXMON machine-code monitor, doing a very good selling job on its debugging facilities. Sinclair very briefly covers breakpointing, single-stepping and relocating programs and ends the main part of the book with a taste of what may be done with the stack, having introduced various operating system calls such as OSRDCH, OSWRCH and OSWORD. At the back there are five appendices covering how numbers are stored in the Electron, hex and denary (decimal) conversion, the instruction set, addressing methods on the 6502, and a section on useful magazines and books.

There is a lot of information in this offering from Sinclair, but it is well presented and extremely well written. This book does not fall into the trap of trying to put too much into too little space and as such, at £6.95, is an excellent introduction to Electron machine-code. This is a book for beginners and as such the gradual introduction to the subject may prove too slow for a programmer with any 6502 machine-code experience.

The Advanced User Guide by Bray, Dickens & Holmes. Price: £12.95, plus P&P for 511 pages.

Acorn's original User Guide can be described as necessary, but not sufficient, as those busy tracking down its errors and omissions will testify. The cover of this volume tells us that instead of merely complaining about the lack of a well-written, accurate book containing advanced programming information, the authors decided to write it.

The result is a 511-page, A5 format, spiral-bound volume, superficially much resembling the User Guide, and containing 28 sections with 11 appendices. It is applicable only to OS 1.2. The first six sections occupy some 100 pages, and deal with operating system commands and the use of machine code, including a complete list of 6502 mnemonics, one to a page. This is not intended to teach machine-code programming, but is a very handy reference source.

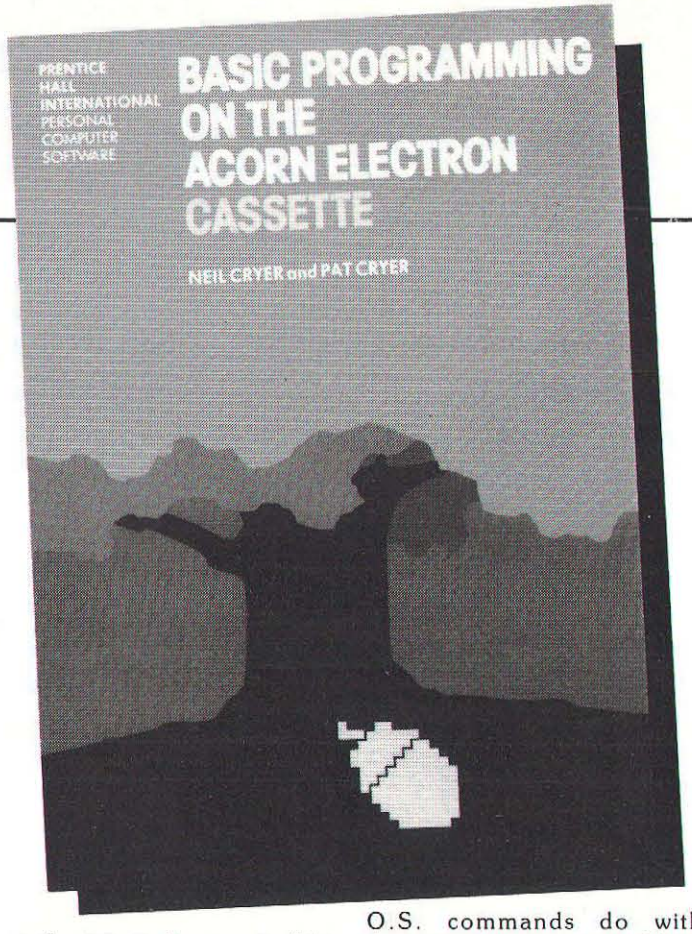
The Advanced User Guide may be somewhat daunting to beginners, but more advanced programmers, wanting to exploit the BBC computer's capabilities to the full and cramped by the obvious limitations of the original User Guide, will find it both challenging and indispensable.

Another ten sections form the largest group in the book, occupying more than 200 pages, and deal with operating system interfacing. Chapters within this group cover vectors, event handling, interrupts, filing systems, and the RS423 interface, with a detailed account of memory allocations. Particularly important is a chapter on paged ROMS, marking out a safe (if complex) route through the minefiled surrounding the programming of these devices. Known previously only to a privileged handful, this information may well trigger a ROM population explosion. There are details of *all* operating system calls, including indocumented ones, and a complete list of *FX/OSBYTE calls. It's nice to know all the *FX calls, even if many are unlikely to find much application.

Appendices contain summaries of all the major calls and codes, plus screen mode layouts and disc upgrade information. For the first time (to my knowledge) we are given a complete list of circuit board links and their functions, a keyboard circuit and a full circuit diagram, the latter on a seperate sheet — don't lose it! The index is comprehensive and adequately cross-referenced. Early copies had binding holes punched through the index entries and were supplied with seperate indexes, but this problem has now been corrected.

The book is written in a clear and very compact style, making few concessions to the reader who expects to be given every concomitant detail. Cross-reference is essential, and the use of page numbers rather than chapter and paragraph would have been more helpful. For the most part a good background knowledge, and the ability to make at least four out of two plus two, are taken for granted. A conveniently brief example concerns interlacing. In a paragraph on interlace control by register R8 of the 6845 we read: ..'default values can easily be changed using *TV(*FX 144) followed by a 0 to turn interlacing on or a 1 turn interlacing off. Taken literally this would not work, and the reader is presumably expected to recognise that this refers to an optional second argument of the *TV command, and that it is effective only after a mode change, whereas a VDU command to reprogramme the R8 register takes immediate effect. These comments are meant to define the probable readership rather than criticise the book, which does, after all, carry the word *advanced* in its title.

It is vitally important for a work of this kind to be error-free, but it will be a long time before enough of the contents can be tested to be sure that it is! Where there are discrepancies between this volume and the official User Guide, the authors claim that their version is more likely to be correct, which demonstrates great confidence. The few mistakes found so far are confined to spelling.



21 Games for the Electron by Mike James, S.M. Gee and Kay Ewbank. Published by Granada. Price: £5.95.

There is an increasing tendency for authors to produce books for the new micros which give a compendium of programs, mainly of the games variety, under the guise of showing how to use BASIC to produce fun programs, whilst at the same time teaching new techniques. The offering under review is one of this variety.

Each of the 21 games that the title refers to has a chapter to itself. Each chapter is split into several sections, namely an introduction to the game, how to play it, typing tips, the subroutine structure of the program, programming details, scope for alteration and (at long last!) the program. Also included at the start of each chapter is a snapshot display of the program to be described. It was looking at these that sowed the seeds of doubt as to having a "Killer Gorilla" or "Jet-Pac"-like set of programs on my hands.

The programs offered are all available on two cassettes (at extra cost, of course) and so the frustration of typing in the programs accurately was not a problem that I encountered. However for those without the tapes, claims in the book are made of full testing and listings within the book are direct from printed computer outputs.

The programs covered ranged from the zap-'em type through to the board-game variety, but whilst I found the "Mirror Tile" and "Capture the Quark" programs excellent, I found just as many (and in fact many more!) extremely disappointing.

Of the 21 programs I could only rate five or six as being programs that I might want to play again. However, I must avoid being too deprecating. One of the stated aims of the book is to promote techniques available from within BASIC and for the beginner there is no doubt that some very good methods are described. The section "programming details" within each chapter has been well thought out as a useful set of pointer to those parts of the program which are most interesting. Ideas for the use of user-defined graphics in animation and the use of high-resolution graphics for smooth movement are covered several times.

I feel that anybody with little experience in BASIC programming with a wish to start programming games should seriously consider looking at this book. It is well structured and easy to read, but I doubt the usefulness of the cassettes since I feel that they could instil laziness in the user and so the teaching power of the book would be greatly diluted.

For those who have done any games programming, this is certainly not the book to keep you slaving over your keyboard for hours at a time.

BASIC Programming on the Acorn Electron by Neil and Pat Cryer. Price: £6.95 for 312 pages.

Based on the BBC version, this book is a solid introduction to BBC BASIC. It combines a clear explanation of what BBC (erroneously called 'Electron') BASIC statements and Electron O.S. commands do with demonstration programs. These are also available on cassette, if you are feeling very lazy — none of the listings is too long to type in.

There are many nice features which allow the learner to get involved in the book and to get to grip with programming techniques which don't always come across in the text of any computer book. These include screen illustrations, word bubbles with comment, tables and diagrams. There are also some humorous cartoons to head the chapters along with a list of topics looked at in each. All chapters end with some points to ponder and discuss plus some 'activities'.

The book is well designed to act as a work of reference, with a full index and detailed page straps. This improves greatly upon the Acorn manual. Nor will you get bored if you have already taken on the manual and the Start Programming book. There are some interesting ideas on sound, colour stippling and animation. The pie chart and histogram programs are excellent examples and you may well be able to put them to good use as procedures in your own programs.

The Cryers emphasise structured programming (the final chapter is dedicated to the subject) so this book should prove a useful follow up to the Electron package. There are some hangovers from the BBC version, like the INKEY value table listing TAB, a key which does not exist on the Electron, but nothing serious. BASIC Programming sensibly confines itself to fundamental aspects of programming and gives itself a chance to fully explain them.

BBC Micro/Electron Assembly Language by Bruce Smith. Published by Shiva. Price: £7.95.

There are two main types of book that are useful to the assembly language programmer. The first type is that which a beginner might read and it must be clear, well-written, informative and, probably most important, it must be fun to read. The second type is that which delves into the intricacies of assembly language, teaching helpful techniques and tricks for the more advanced programmer. My initial impression of "BBC Micro Assembly Language" is that it is not sure which of these it is.

This book covers all the basics essential for learning assembly language. . . . and a lot more! Bruce Smith has started with chapters that any beginner would be pleased to see at the start of this type of work. We see the "why" of assembly language, the manipulation of binary, BCD and logical operators all dealt with, but all too briefly. Why is it that authors assume that everyone understands these topics without need for extensive explanations and examples?

The chapters that follow deal very extensively with the registers, the addressing modes and the stack. These are quite excellent in their detail and will prove valuable as points of reference. Many of the mnemonics available in the BBC assembler are explained with some useful examples being

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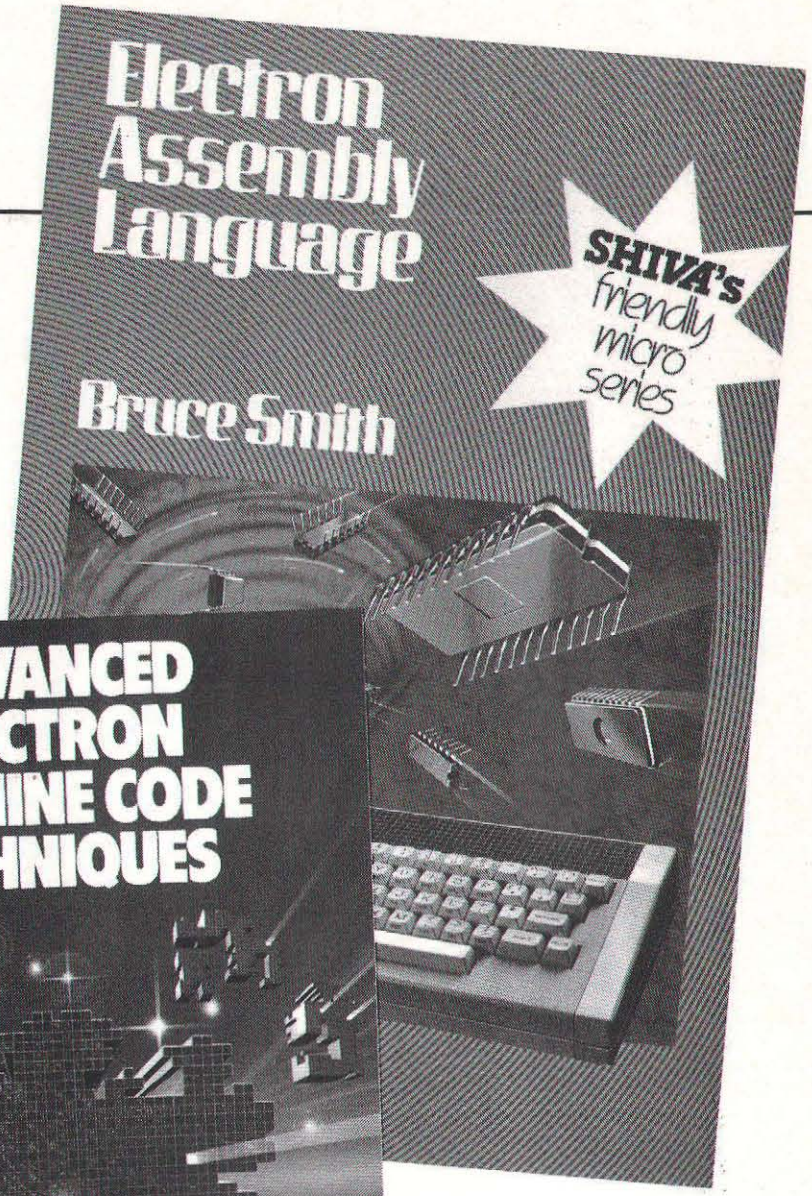
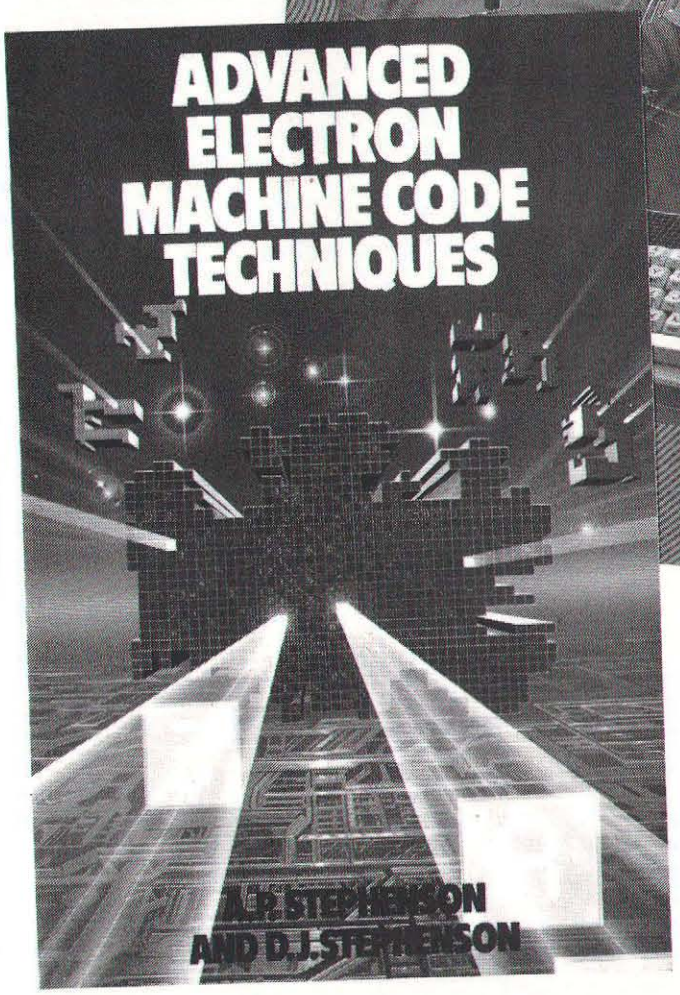
given. But for me the highlight of the book is the chapter entitled "Prepacked Utilities". Within this chapter there are four useful listings, including a very useful register debugging utility which will be valuable for finding those elusive bugs so hard to trace when writing assembler code.

At the back of the book is the standard set of appendices covering information on ASCII codes, the 6502 assembler, a useful section of BASIC instructions in assembler, instruction cycle times and a multitude of other bits and pieces. There is also a section on the new BASIC 2 commands in the EQU family.

My overall impression of the book is that it is a learned work, covering many diverse aspects of BBC assembler. Unfortunately though the book has covered so much that Bruce Smith has fallen into the trap of packing too much into too few pages. I feel that this is a good book as a refresher and concise reference to information on BBC assembler for someone who is not a beginner. I suggest that beginners keep away.





Advanced Machine Code Techniques for the BBC Micro/Electron by A.P. Stephenson and D.J. Stephenson. Published by Granada. Price: £7.95 for (very appropriately) 256 pages.

Machine Code is a difficult subject both to explain as well as learn. The Stephenson duo do their best to give useful comments in the assembler listings but for the newcomer this will not prove enough and here the clarity of the authors' explanation in the text is fully tested. In my opinion, they passed with flying colours. The authors themselves are not averse to admitting the often considerable difficulty in grasping the complexities of directly programming BBC Micro components, especially the 6522 VIA. This understanding leads them to fully describe the effects of each programming operation for programmers less well versed in the world of registers, flags, protocol and handshaking, all driven by the laws of binary logic which BASIC so effectivley 'masks out'.

This book is not for the machine code beginner, but anyone who has dabbled will get enjoyment from both the hardware and software information given here and the assembler listings which demonstrate the sort of speed required in sorting large quantities of data and in moving chunks of colour graphics smoothly around the screen (the authors don't restrict themselves to OS calls but do demonstrate their use as well as direct screen addressing).

Chapters outlining the architecture of the Beeb and looking at the resident assembler make a good introduction before moving on to particular implementations of machine code. It is rightly emphasised that the best way to use the assembler is (just as Acorn designed their chip) from within BASIC.

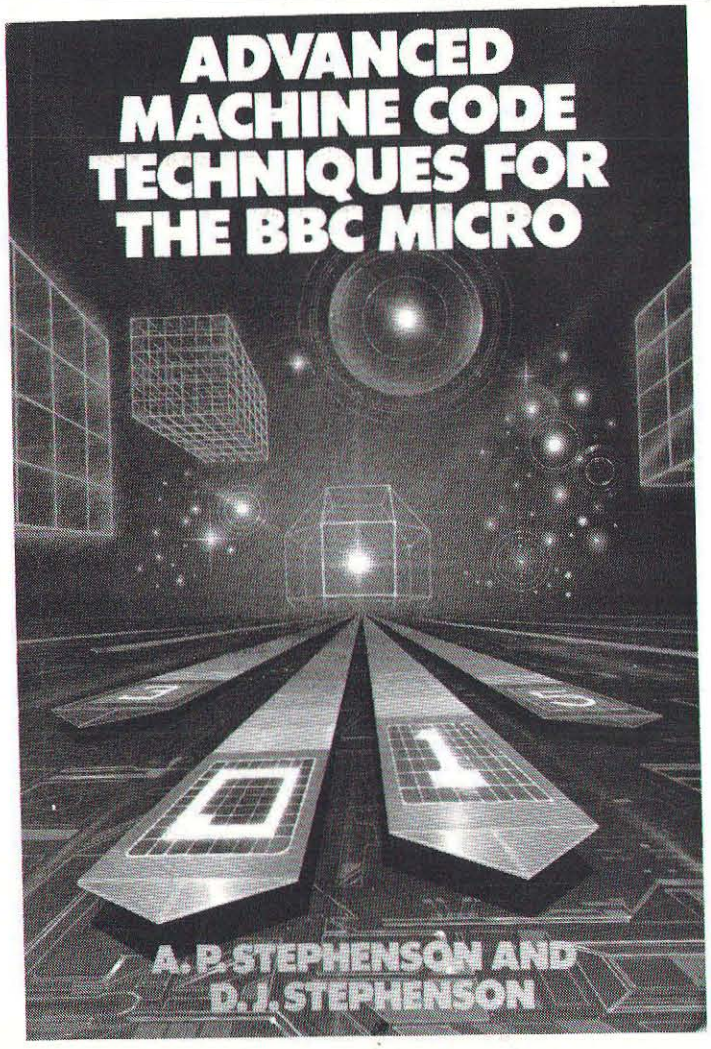
Implementing Macros by hopping between the assembler and BASIC procedures or functions and the use of lookup tables come later and lead to some of the techniques that budding games writers may be looking for. The treatment of interrupts and the User Port is necessarily an introduction and thankfully a clear one.

Nice features of the book in-

clude a list of points which summarise each chapter and a set of self-test questions to see how much you have learned about multibyte loops or hardware scrolling and the like.

The Electron version of the book offers a quick look at some of the hardware features of the machine and concludes that Electron owners have every reason to learn machine code! The chapter on the 6522 is now entitled Interrupts and Expansion and assumes correctly that Electron users will soon require a good knowledge of this chip in association with the user port and printer interface expansions coming on the market.

Advanced Graphics with the BBC Model B Microcomputer by I.O. Angell and B.J. Jones. Price: £9.95 for 291 pages. ISBN 0 333 35052 9.



The screen of the BBC Micro has never looked so impressive as when displaying one of the excellent demonstration listings in this inspirational and detailed book on graphics. The two authors, with their academic background in the department of computer science at Royal Holloway College, have described, explained and exploited most of the possible graphics techniques which can be used on the BBC Micro.

As their preface points out, this is a cheap introduction to the more advanced features of computer graphics. The book retails at £9.95 and there are two complimentary cassettes available at £9.00 each or £16.00 the set. There are certainly some pretty large programs, including a teletext editor, BASIC and machine code scrolling examples and a "large-scale" video game featuring RON, the BEEBS, MUTTS and DEMONS. The latter is only available on the second of the tapes and proves that Angel and Jones are the right people to break us gently into the more mathematical elements of creating perspective and stereoscopic projections, and learning three dimensional coordinate geometry.

The programs in each chapter follow on from one another in content and often combine in the larger examples. The different types of character definers in the chapter on character graphics are a good example. The generators have procedures in common but each one advances the approach that bit further and provides a more comprehensive program. The methods by which the BBC handles its character graphics are stripped bare and the findings put to use in manipulating the size, angle or rotation, and colour of single and concatenated characters.

Nor are these just academic examples; the facilities are provided to save the character definitions for recall and reuse in other programs. This is enhanced by the addition of a machine code routine to print the files to the screen. A typical application I carried out was to convert the BBC into a Greek typewriter. Not everyone's cup of tsai but the scope for invention is huge.

The first chapter is an extremely useful look at the big mapped screen with insights into how different Modes are organised and some nice examples of spirals and polygon drawing. These early chapters serve to whet the appetite before the more heavy tutorial on the mathematical functions which produce this electronic art work. From a computer science point of view, the explanations are thorough and the link between the formal geometry and the graphics screen well made.

The character graphics examples lead into a chapter on diagram and data graphs. This means histograms and pie charts, scientific graphs and the art of labelling. No doubt the economics and science departments will grapple for this chapter since the main programs are very high standard presentations. Have you seen the QL adverts? Well, these are better. The approach here too is to build the main programs from common routines and this cuts down the work if you decide to type them in and find out how they really work.

The geometry and matrix representation of three dimensional graphics each get a chapter and so do Orthographic Projections, a chapter in which the authors "address the problem of drawing views of three dimensional objects on the (necessarily) two-dimensional screen."

Two chapters follow on hidden line and surface algorithms, complex stuff but it works and the examples make it clear what can be achieved even if it is going to take a fair bit of work to understand how and why. The teletext chapter is built around the editor, which is excellent. There are imaginative uses of Mode 7 in other parts of the book but nothing to beat the animated display which stores Mode 7 screens in a buffer, and displays them in turn and quickly, waiting only for screen refresh. Apart from RON, the last chapter goes briefly into some other areas of advanced Programming — as if the rest of the book wasn't advanced. Hardware scrolling is complimented by software scrolling demonstrations. There is also a complete dissassembler - and Search/Replace utility.

The book certainly gives the interested BBC owner a lot to think about and, if not sufficiently trained in the mathematics, a lot of hard learning. The combination of stunning examples and an enthusiastic and clear text however makes this an exciting and stimulatiing book to own.

Software Listings

Want a program for your BBC Micro or Acorn Electron? Look no further than our listings to make your choice.

Finding and choosing the correct software for your needs is a daunting task indeed, whether you are looking for a word processing package or for a new game to test your alien destroying, treasure seeking, pathfinding talents!

Often you can be put off even looking through the pages of advertisements which tempt you with vivid descriptions o f the amazing graphics and sound effects of the game being offered, you sit there with pen poised above cheque book and your eye catches the small print that tells you that the game will run on just about every available machine except the one sitting beside you!

But BBC and Electron owners need despair no longer — help is at hand in the following pages. We have put together as comprehensive a list as possible of the software available for these machines. In order to fit in as many as possible we have had to use codes in some columns. The title of the software, whether it is for the BBC or the Electron, the company which produces it, the form in which it is available, the supplier code and price; all are given for each piece of software listed. The codes used are:

Code	Explanation
Gm	Game
Bs	Business
Ut	Programming utility
Do	Domestic
Ed	Educational
A	Model A BBC
B	Model B BBC
E	Electron
C	Cassette
D()	Disc (40 or 80)
R	Rom or Eprom

As you are probably aware, new software is surfacing all the time so do not asume that there is no such item as the one you are looking for, if it is not included in the following list. Remember that much BBC software is being converted for the Electron and to avoid dissapointment it is best to wait for a specifically written program. If you are aware of a piece of software that is not listed here, whether you are a user or a producer, feel free to let us know.

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
ABC	Ed	Bryants	B C	HW	£4.85
Abductor	Gm	Salamander	A,B C	NZ	£7.95
ABM	Gm	Alligata	A,B C	AG	£5.95
Abyss	Gm	Cases	B,E C	CE	£6.95
Action of the Heart	Ed	Garland Comp.	B C	JX	£11.76
Accounting Ratios	Bs	Microplex	B C	MP	£7.95
Accounts Receivable	Bs	Acornsoft	B D	AL	£24.95
Accounts Payable	Bs	Acornsoft	B D	AL	£24.95
Accurate	Ed	MP Software	B C,D		£11,00/ £14.00
Acids and Alkalis	Ed	Scholar	B C,D	SC	£5.50, £7.50
Add-Tabs and Mul-Tabs	Ed	Cottage Soft	A,B C	CT	£7.50
Ade	Ut	System	B C	SY	£60.00
Adventure	Gm	Program Power	A,B,EC	GK	£7.95
Adventure 1	Gm	Odyssey	B C	OG	£4.50
Adventure 2	Gm	Odyssey	B C	OG	£4.50
Adventure	Gm	Micro Power	B C	GK	£6.95
Adventure	GM	Program Direct	B C	NP	£5.99
Adventure Quest	Gm	Level 9 Computing	B C	CU	£9.90
Adventure Quiz	Ed	Dial	B C,	DL	£4.95, £6.50
Airline	Gm	Cases	B C	CE	£6.95
Algebraic Manipulation	Ut	Acornsoft	B C	AL,G	£9.95
Alien	Gm	FBC	B C	FB	£6.00
Alien Break-in	Gm	Romik	B,E C	RO	£6.99
Alien Destroyer	Gm	Beebug	B C	BE	£7.50
Alien Destroyers	Gm	Program Power	B C	GK	£7.95
Alienswirl	Gm	Amcom	B C	AO	£5.95
Alien Swirl	Gm	Program Power	B C	GK	£6.95
Airlift	Gm	Bug Byte	B C	KP	£5.50
Allaboard	Ed	Arnold-Wheaton	B C	AW	£9.95 + VAT
Alligatacalc	Do	Alligata	B C	SY	£9.95
Anagrams	Do	Cylindrical Software	A,B C	CS	£3.95
Angles and Parallel Lines	Ed	Scholar	B C,D	SC	£5.50, £7.50
Angles and Triangles	Ed	Scholar	B C,D	SC	£5.50, £7.50
Angle Tutor	Ed	Pee Bee	B C,D	PB	£9.95, £12.45
Android Attack	Gm	Computer Concepts	B C	GJ	£7.80
Anagram	Ed	Ed.Soft	B C	ES	£4.95
Angles Navigate	Ed	Primary Programs	B C	PP	£5.95
Angle(4)	Ed	Chalksoft	B C	KT	£6.95
Anglezap	Gm	Gem	B DC	GM	£7.50
Animal/Vegetable/Mineral	Ed	Bourne	B,E C	BO	£8.97, £10.98
Apollo	Gm	Software Invasion	B C	IS	£6.95
Append It	Ut	Aztec S/W	B C	IB	£3.00
Alien Dropout	Gm	Superior Software	B C	SE	£7.95
All Fingers Go	Ed	NEC	B C	NC	£14.95
Alpha	Ed	Golem	B C	OB	£8.05
Alphachopper	Ed	Sulis	B C	SU	£9.95
Alphabet	Ed	J B Software	B C	JS	£4.95
Alphabeta	Bs	H and H Software	B C	HH	£28.50
Android Attack	Gm	Computer Concepts	B C	GJ	£8.95
Animated Arithmetic	Ed	Ludinski CAL	B C/ D	KA	£6.50/ £7.50
Apocalypse	Gm	Red Shift	B C	RS	£9.95
Arcadians	Gm	Acornsoft	B,E C	AL	£9.95, £9.20
Arcade Action	Gm	Acornsoft	B C	GA	£11.90
Arcade 1	Gm	Odyssey	B C	OG	£3.00
Arcade Games	Gm	Ganymede Systems	B C	GY	£9.95
Area of Rectangles	Ed	Scholar	B C,D	SC	£5.00, £7.00
Area of Triangles	Ed	Scholar	B C,D	SC	£7.00, £9.00
Area Radar Controller	Gm	Software For All	B C	KN	£6.95
Arrow of Death (1)	Gm	Digital Fantasia	B C	JT	£6.95
Arrow of Death (2)	Gm	Digital Fantasia	B C	NT	£8.95
Artisan I	Ut	OIC	B,E C	OI	£12.75
Asteroid Storm	Gm	Program Power	B,E C	GK	£7.95
Asteroids/Frong	Gm	Aardvark Software	B C	IU	£4.00
Asteroid Belt	Gm	Electronics Appplied	B C	IF	£11.50
Asteroid Belt	Gm	Computer Concepts	B C	GJ	£7.80
Asteroid Miner	Gm	Optima	B C	OP	£8.95
Astro Navigator	Gm	Micro Power	B C	GK,	£6.95
Atlantis	Gm	IJK Software	B C	IT	£6.95
Atomic Protector	Gm	Optima	B C	OP	£8.95
Atom Smasher	Gm	Romik	B,E C	RO	£6.99
Aviator	Gm	Acornsoft	B C,D	AL	£14.95, £17.65
Awari	Gm	Foilkade	B C	NR	£5.95
Backgammon	Ut	Bug Byte	B C	BB	£8.00
Bailiff	Ed	Sulis	B C	SU	£9.95
Balance Your Diet	Ed	Cambridge Micro	B C,D	CM	£13.95 + £1.62

Ballard	Ed	Ed.Soft	B	C	ES	£3.00
Ballooning	Ed	Heinemann	B	C	HE	£7.25 + VAT
Balloons	Gm	C J E Micros	B	C	NV	£6.00
Bandits at 3 O'Clock	Gm	Program Power	B,E	C	GK	£6.95
Bank	Ed	Primary	B	C,D	PP	£5.95, £7.95
Bank Statement	Ed	Scholar	B	C,D	SC	£6.00, £8.00
Barset and Barpic	Ed	Longman	B	C,D	LM	£14.50 + VAT
Barrage	Ed	Program Power	B	C	GK	£7.95
Base 10	Ed	Dial	B	C,D	DL	£4.95, £6,50
Basic Goodies	Ut	Simonsoft	A,B	C	MS	£5.95
Basic Maths	Ed	Aztec S/W	A,B	C	IB	£3.00
Basic Number Help	Ed	Longman	B	C,D	LM	£9.95, £12.95
Basic Statistics	Bs	Micropak	B	C	MP	£7.95
Battlezone Six	Gm	Kansas	B	C	KA	£9.50
Battlezone 2000	Gm	Lothlorien	B	C	LO	£6.95
Battle Tank	Gm	Superior Software	B	C	SE	£7.95
BBC Artfun	Do	R.H. Electronics	B	C	RH	£9.95
BBC Kaleidoscope	Ed	Dial	B	C	DL	£8.50
BBC Logo	Ed	Dial	B	C,D	DL	£6.50, £8.00
BBC Octuplet	Ed	Dial	B	C	DL	£8.50
Beebart	Ut	Quicksilva	B	C	QS	£14.95
Banner	Do	Micro-Aid	A,B	C	IZ	£2.95
Beat the Bug (Molecule)	Gm	Bridge	B	C	BR	£6.90
Bed Bugs	Gm	Optima	B	C	OP	£8.95
Bee Base	Ut	GCC	B	E	GL	£45.94
Beeb-Chase	Gm	Database Software	B	C	NU	£7.50
Beebmunch	Gm	I.J.K. S/W	B	C	IJ	£5.95
Beebtrek	Gm	Software for All	A,B	C	KN	£7.95
Bells	Ed	Dial	B	C,D	DL	£4.95, £6.50
BEEP-BEEB	Gm	IJK	B	C	IJ	£3.95
Beep-Beeb (Super Simon)	Gm	IJK Software	B	C	IJ	£4.50
Beebcalc	Bs	Gemini	B	C	GM	£19.95
Beebmon	Ut	Program Power	A,B	C	GK	£7.95
Beebplot	Bs	Gemini	B	C	GM	£19.95
Beeboids	Gm	Odyssey	A,B	C	OG	£2.75
Beebon Mon	Ut	McKeran	A,B	C	MK	£2.00
Beebsynth	Ut	Clares	A,B	C	CL	£7.95
Beeb-Tote	Gm	Program Power	B	C	GK	£5.95
Beefeater	Ed	Sulis	B	C	SU	£7.95
Bertie Bear	Ed	Dial	B	C,D	DL	£4.95, £6.50
Besieged	Ed	Sulis	B	C	SU	£9.95
Beyond Basic	Ed	BBC/NEC	A,B	C	KB	£7.25
Billiards	Gm	H and H Software	B	C	HH	£8.50
Birds of Prey	Gm	Romik	B,E	C	RO	£6.99
Bismark	Gm	ASP Software	B,E	C	AS	£6.99
Blagger	Gm	Alligata	B,E	C	SY	£7.95
Boat Race	Ed	Pee Bee	B	C,D	PB	£8.50, £11.00
Blackjack/Textpro	Gm /Ut	Software Invasion	B	C	IS	£6.95
Bomb Alley	Gm	Software Invasion	B	C	IS	£7.95
Bomber Scramble	Gm	Kansas	B	C	KA	£9.50
Bounce	Gm	Computercat	A,B	C	CC	£4.95
Bouncers	Gm	A&F	B	C	GE	£8.00
Bounty Pirates	Gm	Aztec S/W	A,B	C	IB	£5.50
Boris in the Underworld	Gm	Superior	B	C	SE	£7.95
Boxes/Maze	Ed	Primary	B	C,D	PP	£5.95, £7.95
Brain Teasers	Gm	Dynabyte	A,B	C	DB	£5.95
Break-Up	Gm	Miking S/W	B	C	KC	£3.95
Breakout	Gm	I.J.K. S/W	A,B	C	IJ	£3.95
Breakout	Gm	Bryants S/W	B	C	HW	£3.75
Brick 'em in	Gm	Software For All	B	C	KN	£6.95
Bridge to the East	Gm	Ixion	B	C	IN	£8.05
Bridgeman	Gm	Bridge	B	C	BR	£6.90
Budget	Bs	Micropax	B	C	MP	£7.95
Budget-Multiproduct	Bs	Micropax	B	C	MP	£12.95
Budget-Multiproduct	Bs	Micropax	B	D	MP	£25.00
Bugblaster	Gm	Alligata	B,E	C	SY	£7.95
Bug Bomb	Gm	Virgin Games	B	C	VG	£7.95
Business Game	Ed	Acornsoft	A,B	C	AL	£9.95, £9.20
Bun Fun	Gm	Squirrel Software	A,B	C	SS	£6.50

SOFTWARE SUPPLIERS

Supplier Code

AA Anthony Aspitel Software Systems
56 London Road
Harleston
Norfolk
IP20 9BZ

AB ABC Primary
19 Crumstone Court
Longmeadow Estate
Killingworth
Newcastle Upon Tyne

AD Dial Software
72 Downend Road
Downend
Bristol

AG Superior Systems Ltd
178 West Street
Sheffield WS1 4ET

AJ Molimerx Ltd
1 Buckhurst Road
Town Hall Square
Bexhill-on-sea
East Sussex

AK A.S.K. Ltd
London House
68 Upper Richmond Road
London SW15 2RP

AL Acornsoft Ltd
4a Market Hill
Cambridge CB2 3NJ

AM Microplus Software
6 Litton Way
Leeds

AO Amcom
23 Hivings Hill
Chesham
Bucks HP5 2PG

AP Processor Applications
22 Mercer Close
Basingstoke
Hants

AS ASP Software
Number One Golden Square
London W1R 3AB

AV A J Vision Service Ltd
61 Jeddo Road
London W12 9ED

AW Arnold-Wheaton Software
Software Publishing Division
Parkside Lane
Leeds LS11 5TD

BB Bug-Byte
Mulberry House
Canning Place
Liverpool L1 8JB

BE Beebugsoft
PO Box 109
High Wycombe
Bucks HP11 2TD

BK BAKsoft
34 Humberstone Road
Cambridge

BM Blue Moon Software Co.
Freepost
Swanley
Kent BR8 7UY

BO Bourne Educational Software
Headbourne Worthy
Winchester
Hants SO23 7SQ

BR Bridge Software
36 Fernwood
Marple Bridge
Stockport
Cheshire SK6 5BE

BU Busco
16 Colwill Walk
Mainstone
Plymouth

CA Carvells
3/7 Bank Street
Rugby

CD Carsondale Enterprises Ltd
44 Kingsway
Stoke-on-Trent
Staffordshire
ST4 1JH

CG Challenge Games
64 Ferndale Road
London E11

CH Chalksoft Ltd
37 Willowslea Road
Worchester WR3 7QP

CR Computer Rentals Ltd
CRL House
9 Kings Yard
Carpenters Road
London E15 2HO

CR Carswell Computers
Carswell Barn
Faringdon
Oxon SN7 8JN

CS Cylindrical Software
177 College Road
Moseley
Birmingham B13 9LJ

CS Stable Software
Compton Street
Compton
Nr Winchester
Hants

CT Cottage Software
Heather Cottage
Selly Hill
Whitby
North Yorkshire

CU Level 9 Computing
229 Hughenden Road
High Wycombe
Buckinghamshire HP13 5PG

CX Contex Computing
15 Woodlands Close
Cople
Bedford MK44 3UE

DA Davy Computing Ltd
Moorcroft House
2 Clarence Lane
Sheffield S3 7UZ

DB 31 Topcliffe Mews
Wide Lane
Morley
Yorks

DC D.A.C.C. Ltd
23 Waverly Road
Hindley
Greater Manchester
WN2 3BN

DK DK Tronics
Unit 2
Shire Hill Industrial Estate
Saffron Walden
Essex CB11 3AX

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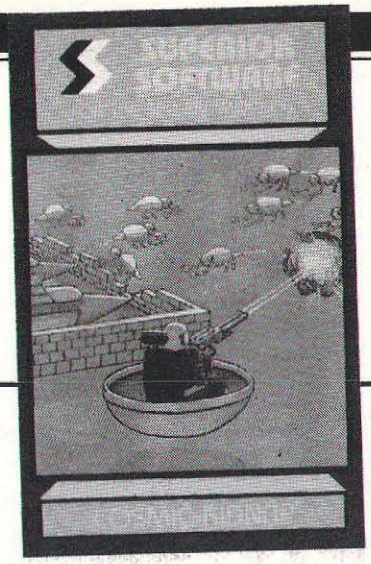

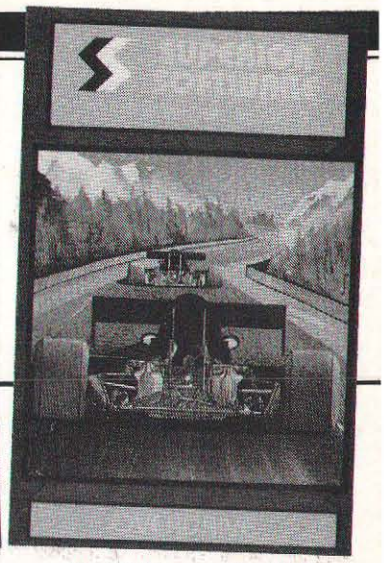

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
Canyon	Gm	BBC Pubs	B C	KB	£10.00
Capitals	Ed	Edsoft	B C	ES	£5.95
Capitals and Punctuation	Ed	RJE Software	A,B C	RJ	£4.95
Carbohydrate Metabolism	Ed	Garland Comp.	B C	JX	£18.24
Car Journey	Ed	Heinemann	B C	HE	£9.25 +VAT
Caplett 1	Ed	Scholar	B C,D	SC	£7.00, £9.00
Caplett 2	Ed	Scholar	B C,D	SC	£5.50, £7.50
Carousel	Gm	Acornsoft	B C	AL	£9.95
Car Race	Gm	Kingfisher	B C	KF	£6.90
Cashbook Accounts	Bs	Gemini	B C	GM	£59.95
Cashbook	Do	Micro-Aid	B C	IZ	£5.95
Cashbook	Do	Micro-aid	A,B C	IZ	£13.95
Cassette 99	Ed	Ludinski CAL	A,B C	KA	£5.00
Castle of Riddles	Gm	Acornsoft	B C	AL	£9.95
Catalog	Bs	Dialog	B C/D	DG	£19.50
Catalogue	Ut	Baksoft	A,B C	BK	£4.00
Cat and Mouse	Ed	Kingfisher	A,B C	KF	£6.90
Cat & Mouse	Gm	Micro Power	A,B C	GK	£4.95
Catchapple	Ed	Kingfisher	A,B C	KF	£6.90
Caveman Adventure	Gm	Program Power	B C	GK	£6.95
Caves of Anoran	Gm	FBC Systems	B C	FB	£7.00
Cells & Serpants	Gm	ASP Software	B,E C	AS	£6.99
Cells & Serpent	Gm	Hexagon S/W	A,B C	JA	£5.00
Centibug	Gm	Superior	B,E C	SE	£7.95
Central Heating	Ed	Heinemann	B C	HE	£9.25 +VAT
Cesil	Ed	Dial	B C,D	DL	£6.50, £8.00
CESCIL	Ed	Eduquest	A,B C	NW	£19.95
Cesil Interpreter	Ed	Computersmith	B C	LC	£15.00
Challenger	Gm	Joe the Liar	B C	JL	£7.45
Character Shapemaker	Ut	Square	B C	SQ	£7.00
Chargen	Ut	Busco	A,B C	BU	£3.95
Chargen and Demo	Ut	Rainbow Research	B C	RR	£8.50
Character Builder	Ut	Davensoft	A,B C	NX	£4.95
Character Enlarger	Ut	Cylindrical Software	A,B C	CS	£3.95
Character Orientating	Ut	Cylindrical Software	A,B C	CS	£3.95
Character Generator	Ut	MP S/W	B C	JZ	£3.00
Character Generator	Ut	Software for All	B C	KN	£4.95
Characters	Ut	Computer Concepts	A,B C	GJ	£6.67
Characters & Envelope Definer	Ut	Electronics	B C	IF	£5.50
Chard	Ut	Applied System	B C	SY	£9.00
Chargen	Ut	Odyssey	A,B C	OG	£4.50
Chemical Analysis	Ed	Acornsoft	B C	AL, G	£13.80
Chemical Collisions	Ed	Cambridge Micro	B D	CM	£15.00 +VAT
Chemical Simulations	Ed	Acornoft	B C	AL, G	£13.80
Chemical Structures	Ed	Acornsoft	B C	AL, G	£13.80
Chemistry	Ed	Program Power	B,E C	GK	£6.95
Chess	Gm	Program Power	A,B C	GK	£5.95
Chess	Gm	Program Power	B,E C	GK	£7.95
Chess	Gm	Acornsoft	B,E C	AL, G	£9,95
Chess	Gm	Bug Byte	B C	EA	£11.50
Children From Space	Ed	A.S.K.	B	AK	£9.95
Childs Play Pack	Ed	Dial	B C,D	DL	£6.50, £8.00
CHI-Squared	Bs	Micropax	B C	MP	£7.95
CHI-Squared, contingency tables	Bs	Micropax	B C	MP	£7.95
Chords	Ed	Aztec	A,B C	AZ	£6.50
Christmas Carols	Do	Ega Beva	B C	EB	£9.95
Circle Tutor	Ed	Pee Bee	B C,D	PB	£9.95, £12.45
Circus	Gm	Digital Fantasia	B C	NT	£8.95
City Defense	Gm	Bug-BYte	B C	BB	£7.50
Classification (In)vertebrates	Ed	Scholar	B C,D	SC	£6.00, £8.00
Claws	Ed	Bryants S/W	A,B C	HW	£3.75
Clone Ranger	Ut	J.C. Software	B D	JS	£11.60
Cloze	Ed	GED Software	B C	GD	£4.50
Cloze Procedure	Ed	Bryants S/W	A,B C	HW	£4.85
Code Breaker	Gm	Program Power	A,B C	GK	£4.95
Code-Breaker	Ed	RJE Software	A,B C	RJ	£4.95
Collectors Catalogue	Do	Acornsoft	B C	AL	£9.95
Code Race	Ut	Computer Concepts	B C	GJ	£6.67
Coin Analysis	Bs	Micro-Aid	B C	IZ	£4.95
Colditz Adventure	Gm	Superior Software	B C	SE	£7.95
Colossal Adventure	Gm	Level 9 Computing	B C	CU	£9.90
Colour Snap	Ed	Ega Beva	B C	EB	£11.95
Comatch	Ed	Clares	A,B C	CL	£4.95
Commercial Accounts	Bs	Gemini	B C	GM	£19.95
Community	Gm	Ixion	B C	IN	£6.90
Compass	Ed	GED Software	B C	GD	£4.50
Compendium	Gm	Computercat	B C	CC	£5.95
Connect 4	Gm	Database Software	B C	NU	£5.90
Conquering Everest	Gm	ASP Software	B,E C	AS	£6.99
Constellation	Ed	Program Power	B C	GK	£6.95
Constellation	Do	Superior	E C	SE	£7.95
Contours/Places	Ed	Primary	B C,D	PP	£5.95, £7.95
Co-ordinates	Ed	Primary	B C,D	PP	£5.95, £7.95
Contract Bridge	Gm	Alligata	B C	SY	£9.95
Contribution Analysis	BS	Micropax	B C	MP	£7.95
Cookbook Wizardry	Do	Database Software	B C	NU	£7.50
Corn Cropper	Gm	Cases	A,B,EC	CE	£6.95
Corporate Climber	Gm	Dynabyte	B,E C	DB	£7.95
Cosmic Asteroids	Gm	Alligata	B C	AG	£4.95
Cosmic Fighters	Gm	Kansas	B C	KA	£9.50
Cosmic Kidnap	Gm	Superior	B C	SE	£7.95
Coucapcur	Ed	Ed. Soft	B C	ES	£4.95
Countdown to Doom	Gm	Acornsoft	B C	AL,	£9.95
Counter Attack	Gm	OIC	B C	OI	£6.50
Counting	Ed	Clares	A,B C	CL	£4.95
Counting	Ed	Cottage Software	B C	CT	£9.50
County (SW/SM)	Ed	Bryants	A,B C	HW	£4.85
Cowboy Shoot-out	Gm	Micro Power	B C	GK	£5.95
Cranky	Ed	A.S.K.	B C	AK	£9.95
Crazy Cut	Gm	R.H. Electronics	B C	RH	£8.95
Crazy Painter	Gm	Superior Software	B C	SE	£7.95
Creating a Monster/Word Finder	Ed	Heinemann	B C	HE	£9.25 +VAT
Creative Graphics	Ut	Acornsoft	B,E C	AL	£9.95
Cricket	Gm	SJG Soft	B C	SJ	£7.50
Crime and Detection Quiz	Do	Acornsoft	B,E C	AL	£12.65
Croaker	Gm	Program Power	B,E C	GK	£9.95
Crocodiles	Ed	Bryants	A,B C	HW	£4.85
Crossed Words	Ed	Aztec S/W	A,B C	IB	£6.50
Crunch	Ed	Oxhey Tutors	B C	OT	£6.50
C. Rules	Ed	Ed. Soft	B C	ES	£5.95
Cube Master	Gm	Acornsoft	B C/AL		£9.95
Curse of the Middle	Gm	Merlin	B C	MN	£7.95
Curve Stitch Planner	Do	Dial	B C,D	DL	£4.95, £6.50
Cut 'n' val	Ed	MP Software	B C,D	MP	£14.50, £17.50
Cybertron Mission	Gm	Micropower	B C GK		£7.95
Cylon Attack	Gm	A&F	B C	GE	£8.00
Dairy Farmer	Ed	Heinemann	B C	HE	£9.25 +VAT
Dallas	Gm	Cases	A,B,EC	CE	£6.95
Dambusters	Gm	Alligata	B C	SY	£7.95
Danger! UXB	Gm	Program Power	B,E C	GK	£7.95

Dap 1	Ut	Gnomonica	B,E	C	GN	£15
Dap 2	Ut	Gnemonica	B	C	GN	£20
Dare Devil Dennis	Gm	Visions	B	C	VI	£7.95
Database	Ut	Computercat	B	C	CC	£12.95
Database	Bs	Gemini	B	C	GM	£19.95
Data-Quiz	Ut	Bryants S/W	B	C	HW	£4.88
Database	Ut	R. H. Electronics	B	C	RH	£12.95
Database	Bs	Acornsoft	B	C	AL	£11.90
Database	Ed	Ed. Soft	B	C	ES	£19.95
Database	Bs	Primasoft	B	C	CT	£9.95
Database	Bs	Computercat	A,B	C	IJ	£11.95
Database	Bs	Software for All	A,B	C	KN	£9.95
Data File	Do	Kansas	B	C	KA	£12.50
Datext	Ut	Optima	B	C	OP	£9.95
Dating Game	Do	Acornsoft	B	C	AL	£12.65
Defchr	Ut	Micro-Aid	A,B	C	IZ	£2.95
Demon Decorator	Gm	Program Power	B	C	GK	£6.95
Demon Knight	Gm	ASP Software	B,E	C	AS	£6.99
Density and Circuit	Ed	Acornsoft	A,B	C	AL	£11.90
Descender	Gm	FBC Systems	B	C	FB	£7.50
Design	Ut	Beebug	B	C,D	BE	£10.00, £19.00
Desk Diary	Bs	Acornsoft	A,B,E	C	AL	£9.95
Detective	Gm	ASP Software	B,E	C	AS	£6.99
Detective	Gm	Computersmith	B	C	LC	£5.50
Devil's Causeway	Gm	Anirog Computers	A,B	C	0A	£6.00
DFM Database	Bs	Dialog	B	C/D	DG	£24.00
DFS Upgrade	Ut	Alligata	B	E	SY	£29.95
DFM Mail Labels	Bs	Dialog	B	C/D	DG	£10.00
Dictator	Gm	D. K. Tronics	B	C	DK	£6.95
Disassembler	Ut	Superior	E	C	SE	£7.95
Disassembler	Ut	Simonsoft	A,B	C	MS	£6.95
Dissassembler	Ut	Micro Power	A,B	C	GK	£5.95
Dissassembler	Ut	Program Direct	A,B	C	NP	£3.00
Dissassembler	Ut	Davansoft	A,B	C	NX	£5.95
Dissassembler	Ut	C J E Microcomputers	A,B	C	NV	£5.00
Distances	Ed	Micro-Aid	B	C	IZ	£4.95
Dissembler	Ut	Rainbow S/W	A,B	C	KS	£2.50
Digital X-Word Compiler	Gm	N. Darwood	A,B	C	JB	£6.00
Dmon	Ut	Alligata	A,B	C, D, E	AG	£7.95, £11.95, £19.95
Dmove	Ut	FBC Systems	B	C	FB	£12.50
DNA Replication	Ed	Garland Comp.	B	C	JX	£17.65
Dodgy Dealer	Gm	OIC	B	C	OI	£6.50
Dracula Island	Gm	Kansas	B	C	KA	£9.50
Dragon Rider	Gm	Salamander Software	B	C	SA	£7.95
Dragon Quest II	Gm	Bug Byte	B	C	KP	£11.50
Dragon Quest	Gm	Bug Byte	B	C	KP	£11.50
Draughts/Reversi	Gm	Acornsoft	B,E	C	AL	£9.95, £9.20
Draughts	Gm	Superior	B,E	C	SE	£6.95
Draw	Ut	Program Power	B,E	C	GK	£9.95
Drawing	Ut	B.B.C.	A,B	C	KB	£10.00
Drawing Pictures and Puzzles	Ed	Ega Beva	B	C	EB	£9.95
Dr. Who: The First Adventure	Gm	BBC Pubs	B	C	KB	£10.00
Dungeon Adventure	Gm	Level 9 Computing	B	C	CU	£9.90
Dynamic Nuclear Magnetic Resonance Spectroscopy	Ed	Microwave	B	C	MW	£3.95
Eagle Empire	Gm	Salamander	B	C	SA	£7.95
Eagle Empire	Gm	Alligata	B	C	SY	£7.95
Early Learning	Ed	B.B.C.	A,B	C	KB	£10.00
Early Numbers	Ed	Bryants S/W	B	C	HW	£4.80
Early Warning	Gm	A&F Software	A,B	C	GE	£6.00
Easycalc	Bs	Zero Software	B	C	AZ	£12.95
Easy Graphics	Ut	Hexagon Software	B	C	HX	£13.50
Easywrite	Ed	System Software	B	C	SY	£10.00
Ecological Simulations	Ed	Garland	B	C	JX	£16.50
E.D.G. Graphics Package	Ut	Salamander	B	C,D	SA	£19.95, £24.95
Ed-master	Ed	R. H. Electronics	B	C	RH	£12.95
Educare's 50	Ed	Educare	A,B	C	EU	£7.95
Education (1)	Ed	Microplus	A,B	C	AM	£4.25
Educational (1)	Ed	Golem	A,B,E	C	OB	£8.00
Educational (2)	Ed	Microplus	A,B	C	AM	£5.25
Educational (2)	Ed	Golem	A,B,E	C	OB	£8.00
Education (3)	Ed	Microplus	B	C	AM	£5.25
7 Educational Games	Gm	Micromail	B	C	OE	£5.75

SOFTWARE SUPPLIERS

DG Dialog
19 Short's Gardens
London WC2H 9AT

DO Doctor Soft
258 Coneygree Road
Peterborough
PE2 8LR

DS Diamondsoft Ltd
Cheadle Hulme
Cheadle
Cheshire SK8 5YB

EB Ebury Software
National Magazine House
72 Broadwick Street
London W1V 2BP

EG SESS Ltd
Central Trading Estate
275-277 Bath Road
Bristol BS4 3EH

EH Heinemann
Computers in Education
22 Bedford Square
London

EJ Logic Systems
85 Hemingford Road
Cambridge

EL ECL Software
29 Richmond Close
Ware
Herts SG12 0EN

ET Etna Software
West End House
West End Lane
Marshchapel Lincs

EU Educare
139a Sloane Street
London SW1X 9AY

FB FBC Systems
10 Castlefields
Main Centre
Derby

FM 4MAT Educational Software
Linden Lea
Rock Park
Barnstaple
Devon EX32 9AQ

FY Wida Software
2 Nicholas Gardens
London W5 5HY

GC Gem Software
Unit D
The Maltings
Station Road
Sawbridgeworth
Herts

GD 70 Stoke Road
Bletchley
Milton Keynes

GE A&F Software
83 Hyde Road
Gorton
Manchester M18 7JD

GJ Computer Concepts
16 Wayside
Chipperfield
Hertfordshire WD4 9JJ

GK Micro Power Ltd
8/8a Regent Street
Chapel Allerton
Leeds LS7 4PE

GM Gemini
9 Salterton Road
Exmouth
Devon EX8 2BR

GR Griffin Software
285 Ealing Road
Alperton
Wembley
Middlesex
HA0 1HJ

GS Gaelsett Software
44 Exeter Close
Stevenage
Herts
SG1 4PW

GY Huntsman Walk
Rugeley
Staffs WS15 2SN

HC H.C.C.S. Associates
533 Durham Road
Low Fell
Gateshead
Tyne and Wear NE9 5EY

HE Heinemann Computers in Education
Freepost EM17
The Windmill Press
Kingswood
Tadworth
Surrey KT20 6BR

HG J Hargreaves
Updown
Pewley Way
Guildford
Surrey

HN Hutchinson
17-21 Conway Road
London W1P 6JD

HW Bryants (Educational) Software
1 The Hollies
Chalcraft Lane
North Bersted
Bognor Regis PO21 5SX

HX Hexagon Software
17 Straits Road
Gornal
Dudley
West Midlands
DY3 2UR

IB Aztec Software
25 St Mark Road
Deepcar
Sheffield
S30 5TS

IC Ian Copestake
23 Connaught Crescent
Brookwood
Woking
Surrey
GU24 0AN

IF Electronics Applied
4 Dromore Road
Carrickfergus
County Antrim BT38 7PJ

IJ I J K Software
9 King Street
Blackpool
Lancs

IN Ixion Software
10 The Crescent
Lympsham
Weston-Super-Mare
Somerset BS24 0BN

IS Software Invasion
50 Elborough Street
Southfields
London

IU Aardvark Software
15 Queensberry Avenue
Hartlepool
Cleveland TS26 9NW

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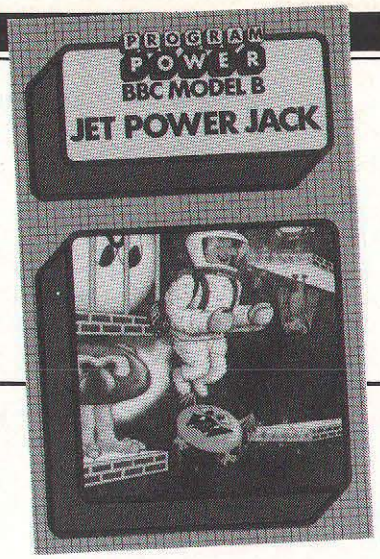

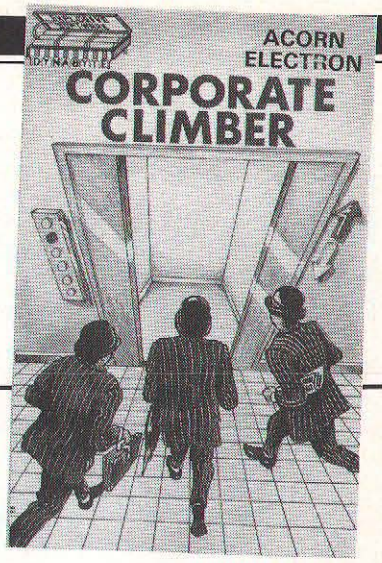

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
Eiffel Tower	Ed	Chalksoft	B C	CH	£9.25
Eldorado Gold	Gm	Program Power	B C	GK	£6.95
Electric	Ed	Database Software	A,B C	NU	£5.50
Electricity	Ed	Primary Programs	B C	PP	£5.95
Electron-Aid	Ut	Dynabyte	E C	DB	£6.95
Elem-add and Elem-sub	Ed	Cottage Soft	B C	CT	£7.50
Empire	Gm	Shards	B,E C	SH	£6.95
Envelope Generator	Ut	System	B C	SY	£7.00
Equation Balance	Ed	RJE Software	B C	RJ	£7.95
Escape From Moonbase Alpha	Gm	Program Power	B,E C	GK	£7.95
Essential French Verbs	Ed	Carsondale	B C	CD	£11.50
European Studies	Ed	Aztec S/W	B C	IB	£6.50
Escape from Pulsar 7	Gm	Digital Fantasia	B C	NT	£8.95
Exmon	Ut	Beebug	B CE	BE	£10.00, £23,00
Explorer	Ed	Longman	B C,D	LM	£9.95, £12.95
Extended Colour Fill Graphics	Ed	Gaelsett Software	B C	GS	£10.00
Experiments in Artifical Intelligence	Ed	Ganymede Systems	B C	GY	£9.95
Eye	Ed	Longman	B C	LM	£14.50
Facemaker	Ed	A.S.K.	B C	AK	£9.95
Factfile	Ed	Cambridge Micro	B C,D	CM	£20.08
Family Finance	Do	R.H. Electronics	B C	RH	£12.95
Family Games	Gm	I.J.K. Software	A,B C	IJ	£4.50
Fantasy Adventure	Gm	Dial	B C,D	DL	£6.50, £8.00
Fairground	Gm	Superior Software	B C	SE	£7.95
Fairytale	Gm	Molimerx	B C	AJ	£10.06
Feasibility Experiment	Gm	Digital Fantasia	B C	NT	£10.29
Female Reproductive Cycle	Ed	Garland	B C	JX	£12.00
Felix and the Fruit Monsters	Gm	Program Power	B,E C	GK	£7.95
Felix In The Factory	Gm	Program Power	B,E C	GK	£7.95
F For Freddie	Gm	Kansas	B C	KA	£9.50
Fighter Pilot	Gm	Kansas	B C	KA	£9.50
File Handler	Ut	Dial	B C,D	DL	£6.50, £8.00
Finance Pack	Bs	Dial	B C,D	DL	£4.95, £6.50
Filer	Bs	Micro Power	A,B,EC	GK	£8.95
Final Accounts Program	Bs	Gemini	B CD	GM	£59.95
First Count	Ed	Scholar	B C,D	SC	£5.00, £7.50
First Steps in Algebra	Ed	Small School	B C	SM	£6.95
Firehawks	Gm	Postern	B C	PT	£6.95
Fishy Business	Gm	Salamander	B C	SA	£9.95
Flint's Gold	Gm	Micrograf	B C,D	MF	£6.95, £9.95
FIZZ BUZZ	Ed	G.E.D. Software	B C	GD	£4.50
Fizz Buzz	Ed	Bourne	A,B C	B	£4.50
Flags	Ed	IJK Software	B C	IJ	£4.50
Flags	Ed	Micro-Aid	B C	IZ	£5.95
Flanders	Ed	Focusplan	A,B C	FP	£5.95
Flexibase	Dm, Bs	Alligata	B C	AG	£9.95, £13.95
Flint's Gold	Gm	Micrograf	B C,D	MF	£6.95, £9.95
Floater	Ed	Cambridge Micro	B D	CM	£15.00 + VAT
Flush	Ut	Micro-Aid	A,B C	IZ	£1.00
Football Pools Predictor	Do	Mayday Software	A,B C	IX	£4.99
Footer	Gm	Program Power	B C	GK	£7.95
Forecast	Bs	Acornsoft	B C	AL	£11.90
Forecasting-single exponential	BS	Micropax	B C	MP	£4.95
Forecasting-double exponential	Bs	Micropax	B C	MP	£7.95
Forth	Ut	Aztec	B C	AZ	£16.85
Forth	Ut	H.C.C.S.	B C	HC	£34.72
Forth	Ut	Level 9 Computing	A,B C	CU	£15.00
Forth Toolkit	Ut	Level 9 Computing	B C	CU	£12.00
FORTH	Ut	Acornsoft	B,E C	AL	£16.85, £16.10
Four-in-a-Row	Gm	Dial	B C,D	DL	£4.95, £6.50
Frac Attack	Ed	Shards	B C,D	SH	£6.95, £9.95
Fraction Chase	Ed	GED Software	B C	GD	£4.00
Fractions	Ed	Garland	B C	JX	£7
Fracts	Ed	Cottage Soft	B C	CT	£7.50
Franklins Tomb	Gm	Salamander	B C	SA	£9.95
Freefall	Gm	Acornsoft	B,E C	AL	£9.95, £9.20
French Connections	Ed	Cambridge Micro	B C,D	CM	£15.00 + VAT
French Vocabulary	Ed	Dial	B C	DL	£8.50
French Irregular Verbs	Ed	Carsondale	B C	CD	£18.86
French Mistress 1/2	Ed	Kosmos	B C	KM	£9.95
French Vocabulary	Ed	Hargreaves	B C	HG	£6.50
French Text Fill	Ed	Carsondale	B C	CD	£9.95
French Tutor	Ed	Salamander	B,E C	SA	£9.95
Fractions Illustrated-1	Ed	RJE Software	B C	RJ	£5.95
Fractions Illustrated-2	Ed	RJE Software	B C	RJ	£5.95
French Abroad	Ed	Micro-Aid	B C	IZ	£7.95
Frenzy	Gm	Persoft	A,B C	IY	£5.75
Froggy	Gm	Superior	B C	SE	£7.95
Frogjump	Gm	Sapphire	B C	SH	£5.95
Frogger (Machine Code)	Gm	A&F Software	B C	GE	£8.00
Froglet	Gm	ASP Software	B,E C	AS	£6.99
Fruit Machine	Gm	Superior Software	B,E C	SE	£7.95
Fruit Machine	Gm	Bug Byte	B C	KP	£5.50
Fruit Machine	Gm	Alligata	B,E C	AG	£5.95
Fruit Machine	Gm	Computersmith	B C	LC	£5.50
Fruit Machine + Honest Joe	Gm	Beebug	B C	BE	£7.50
Fruity	Gm	Odyssey	B C	OG	£3.00
Fun to Learn	Ed	Shards Soft	B C,D	SH	£6.95, £9.95
Fun Pack	Gm	Sapphire	B C	SH	£5.95
Fun plot	Ed	Edsoft	B C	ES	£5.95
Fun Sums	Ed	Kosmos	A,B C	KM	£4.95
Fun with Numbers	Ed	Golem	B,E C	OB	£8.00
Fun with Words	Ed	Golem	B,E C	OB	£8.00
Fun Games	Gm	B.B.C.	A,B C	KB	£10.00
Galactic Commander	Gm	Micro Power	B,E C	GK	£6.95
Galactic Firebird	Gm	Kansas	B C	KA	£9.50
Galactic Wipeout	Gm	R. H. Electronics	B C	RH	£8.95
Galaxy Birds	Gm	Superior	B C	SE	£7.95
Galaxy Wars	Gm	Bug-Byte	B C	BB	£7.50
Games Compendium B1/2	Gm	Salamandar	B C	SA	£6.95
Games Pack 1/2	Gm	Processor Applications	B C	AP	£5.95
Games Pack 1	Gm	Computersmith	B C	LC	£5.50
Games Tape 1	Gm	Pro Software	A,B C	SP	£7.95
Games Pack 1	Gm	Computersmith	A,B C	LC	£5.50
Game of Logic	Ed	N. Darwood	A,B C	JB	£8.00
Games of Logic and cunning	Gm	Golem	A,B,EC	B	£4.95
Games of Strategy	Gm	B.B.C.	A,B C	KB	£10.00
Games Pack II	Gm	Micromail	B C	OE	£6.75
G.B. Geograph6	Ed	Primasoft	B C	PR	£6.95
GCE Maths (O) 1/2	Ed	Bryants	A,B C	HW	£9.50
Genetic Code	Ed	Garland Comp.	B C	JX	£17.65
Geography Map	Ed	Bryants	B C	HW	£4.85
Geography France/Spain/Germany/Italy/Belgium/USA/India	Ed	Corona	B C,D	JY	£6.00, £9.00
German Irregular Verbs	Ed	Carsondale	B C	CD	£13.80
Get it Right	Ed	Sulis	B C	SU	£9.95
Get Set	Ed	Griffin	B C	GR	£9.95
Get the Message	Gm	Dial	B C,D	DL	£4.95, £6.50
Ghost/Diamonds	Gm	A Lane	A,B C	0C	£3.00

Ghost Maze	GM	Software for All	B	C	HN	£6.95
Gideon's Gamble	Gm	Superior Software	B	C	SE	£7.95
Glooper	Gm	Microplus	B	C	AM	£6.95
Glycolysis – TCA Cycle	Ed	Garland	B	C	JX	£15.00
Gnasher	Gm	Superior	B	C	SE	£6.95
Gobbler	Gm	M G B	B	C	MG	£5.45
Golf	Gm	Microplus	B	C	AM	£4.95
Golf	Gm	Computersmith	B	C	LC	£5.50
Golforama	Gm	Dial	B	C,D	DL	£4.95, £6.50
Grand Prix	Gm	Software for All	B	C	HN	£5.95
Grand Prix	Gm	Microplus	A,B	C	AM	£4.25
Graph Capers Senior	Ed	Gem	B	C	GM	£8.50
Graphs	Ed	Bryants	A,B	C	HW	£4.85
Graphics Aid Pack	Ed	Microwave NW	B	C	MW	£8.95
Grafix	Ut	Williams	B	D	WI	£10.00
Golf	Gm	Bryants S/W	B	C	HW	£4.88
Golf	Gm	Bug Byte	B	C	BB	£7.00
Golf	Gm	Computersmith	B	C	LC	£5.50
Gomoku	Gm	Micro Power	A,B	C	GK	£3.95
Graphics Package	Ut	Salamander Software	B	C	NZ	£24.95
Graph and Charts Pack	Bs	Acornsoft	B,E	C	AL	£9.95, £9.20
Graphics Pack	Ut	Bug-Byte	B	C	BB	£9.50
Graphs (Arithmetical)	Ed	Bryants	B	C	HW	£4.85
Great Britain Ltd	Gm	Hessel	B	C	HS	£5.95
Greater and Smaller	Ed	Scholar	B	C,D	SC	£6.50, £8.50
Grig Blitz	Gm	Computercat	B	C	CC	£5.95
Group Statistics	Bs	Micropax	B	C	MP	£7.95
Guardian	Gm	Alligata	E	C	SY	£7.95
Guided Discovery	Ed	Etna Software	B	C	ET	£9.95
Gunsmoke	Gm	Software Invasion	B	C	IS	£7.95
Guzzler	Gm	Cpmputersmith	B	C	LC	£5.50
Handwriting 1/2	Ed	Chalksoft	B	C	CH	£9.95
Hangdroid	Gm	Micromode	B	C	MO	£4.00
Hangman	Ed	Micro Aid	B	C	IZ	£7.95
Hangman Player	Ed	Square	A,B	C	SQ	£7.00
Hangman	Gm	Micro Aid	B	C	IZ	£7.95
Hangman	Gm	Aztec S/W	A,B	C	IB	£5.50
Hangman	Gm	MP S/W	B	C	JZ	£4.00
Happy Letters	Ed	Bourne	B,E	C	BO	£8.97
Happy Numbers	Ed	Bourne	B,E	C	BO	£8.97
Harmony	Ut	Doctor Soft	B	C	DS	£6.95
Heist	Gm	Softspot	B	C	SF	£6.95
Helicopter Rescue/Tunnel/ Roadrace	Gm	A Lane	A,B	C	OC	£4.00
Hell Driver	Gm	Program Power	B,E	C	GK	£7.95
Hide and Seek	Ed	A.S.K	B	C	Ak	£9.95
History Quiz	Do	Acornsoft	B,E	C	AL	£12.65
Hitch Hiker	Gm	Computer Concepts	B	C	GJ	£7.80
Home Accounts	Do	Diamondsoft	B	C	DS	£14.95
Home Accounts	Bs	Gemini	B	C	GM	£19.95
Home Accounts	Do	Persoft	B	C	IY	£12.50
Home Finance	Do	B.B.C.	A,B	C	KB	£10.00
Hooked on Numbers	Ed	Acornsoft	B	C	AL	£9.95
Hopper	Gm	Acornsoft	B,E	C	AL	£9.95, £9.20
Horror Castle	Gm	A&F	B	C	GE	£8.00
Horserace	Gm	Dynabyte	B,E	C	DB	£6.95
Hot Cakes	Ed	Private Tutor	B	C,D	PT	£7.95, £8.95
Housekeeper	Ed	Heinemann	B	C	HE	£9.25 + VAT
Howszat	Gm	A&F	B	C	GE	£6.90
Human Blood Groups	Ed	Garland	B	C	JX	£15
Hunchback	Gm	Superior Software	B	C	SE	£7.95
Hydraulics	Ed	Database Software	A,B	C	NU	£5.50
Hyperdrive	Gm	IJK	B	C	IT	£6.50
'. . . I Do'	Do	Acornsoft	B	C	AL	£12.65
Indentikit/Word Finder	Ed	Heinemann	B	C	HE	£9.25 + VAT
Index	Ut	Microwave NW	B	C	MW	£6.95
Index Numbers-Basket	Bs	Micropax	B	C	MP	£7.95
Index Numbers-Changer	Bs	Micropax	B	C	MP	£7.95
Indexit	Ut	Williams	B	D	WI	£10.00
Inhabitant	Ed	Longman	B	C,D	LM	£9.95, £12.95
Inheritance	Gm	S.W. Hessel S/W	B	C	IW	£5.95
Inheritance	Ed	Garland Comp.	B	C	JX	£34.70
Inkosi	Gm	Chalksoft	B	C	KT	£5.95

SOFTWARE SUPPLIERS

IV James Hager
7 Basset Street
Camborne
Cornwall TR14 8SW

HS Simon Hessel Software
15 Lytham Court
Cardwell Crescent
Bershire

IX Mayday Software
181 Portland Crescent
Stanmore
Middlesex HA7 1LR

IY Persoft
Freepost
Baildon
Shipley
West Yorkshire BD17 5SX

IZ Micro Aid
25 Fore Street
Praze Camborne
Cornwall TR14 0JX

JL Joe the Lion
213/215 Market Street
Hyde
Cheshire
SK14 1HF

JS J.B. Software
57 Meadow Crescent
Carleton
Poulton-le Fylde
Lancashire
FY6 7QX

JA Hexagon Software
17 Cambridge Grove
Otley

JB N Darwood Ltd
Halfacres
Stroud
Petersfield
Hampshire GU32 3PJ

JC Futura Software
63 Lady Lane
Chelmsford
Essex CM2 OTQ

JS J.C. Software
124 Woodlands Way
Southwater
West Sussex
RH13 7DR

JX Garland Computing
35 Dean Hill
Plymouth PL9 9AF

JY Corona Software
Corona House
21 Tennyson Avenue
London E11 2QN

JZ MP Software & Services
165 Spital Road
Bromborough
Merseyside L62 2AE

KA Kansas City Systems
Unit 3
Sutton Springs Wood
Chesterfield S44 5XF

KB BBC Publications
British Broadcasting Corporation
35 Marylebone High Street
London W1M 4AA

KF Kingfisher Computer Services
Durley Lane
Keynsham
Bristol BS18 2AQ

KH Superior Software
69 Leeds Road
Bramhope
Leeds

KM Kosmos
1 Pilgrims Close
Harlington
Dunstable
Bedfordshire
LU5 6LX

KN Software for All
72 North Street
Romford
Essex

KU Kudusoft
130 Main Street
Tweedmouth
Berwick-upon-Tweed
TD15 2AW

LA Ludinski Computer-Assisted Learning
24 Avondale Avenue
Staines
Middlesex

LC Computersmith
40 Greenfields Avenue
Bromborough
Wirral
Merseyside L62 6DD

LM Longman Group
Longman House
Burnt Mill
Harlow
Essex

LO Lothlorien
56a Park Lane
Poynton
Cheshire SK12 1AE

MA MP Software and Services
165 Spital Road
Bromborough
Merseyside L62 2AE

MB Microbyte Software
Freepost
Newquay TR7 2BR

MD MED
640 Melton Road
Thurmaston
Leics

MF Micrograf
120 Oxford Road
Reading
Berkshire RG1 7NL

MI Microgame Simulations
73 The Broadway
Grantchester
Cambridge
CB3 9NQ

MG MGB Software Support
52 Barley Croft
Harlow
Essex

MK David McKeran
23 Warwick Drive
East Herrington
Sunderland
Tyne and Wear

MM M and M Software
1391 Leek Road
Abbey Hulton
Stoke-on-Trent
Staffs ST2 8BW

MN Merlin Computer Products
18 Mansel Street
Swansea SA1 5SG

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
Intervention commercial	Bs	System	B C	SY	£345.00
Intervention educational	Ed	System	B C	SY	£115.00
Intro	Ed	Clares	A,B C	CL	£7.95
Introducing Map Skills 1/2	Ed	Cambridge Micro	B C,D	CM	£13.95, £1.62
Introduction to Microcomputing in Teaching	Ed	Hutchinson	B C	HN	£17.25
Invaders	Gm	Software Invasion	B C	IS	£6.95
Invaders	Gm	Superior Software	B C	SE	£7.95
Invaders	Gm	Software for All	A,B C	KN	£6.95
Invaders	Gm	Hexagon S/W	A,B C	JA	£6.00
Invasion	Gm	ASP Software	B,E C	AS	£6.99
Invisible Man	Ed	Chalksoft	B C	KT	£5.95
Invoicing	Bs	Acornsoft	B D	AL	£24.95
Invoices and Statements	Bs	Gemini	B C	GM	£19.95
Janeplus	Ed	Longman	B C	LM	£14.50
Jars	Ed	Acornsoft	B C	AL,	£11.90
JCB Digger	Gm	Acornsoft	B C	AL	£9.95, £11.50
Jigsaw Puzzle	Ed	Ega Beva	B C	EB	£9.95
Johnny Reb	Gm	Lothlorien	B C	LO	£6.95
J.R.	Gm	Software for All	B C	KN	£6.95
Jumbles	Ed	Bryants S/W	B C	HW	£4.88
Jumbo	Gm	Molimerx	B C	AJ	£17.25
Jungle Ambush	Gm	Kindsoft	B C	KU	£6.50
Junior Maths	Ed	Aztec	A,B C	AZ	£3.00
Junior Maths Pack	Ed	Program Power	B C	GK	£6.95
Junior Word Splits	Ed	Sulis	B C	SU	£9.95
Just a Mot	Ed	Sulis	B C	SU	£9.95
Kamikaze	Gm	A&F	E C	GE	£7.90
Keeping Myself Alive	Ed	Heinemann	B C	HE	£9.25 + VAT
Katakombs	Gm	Golem	B C	OB	£5.95
Keyrecog	Ed	Ed. Soft	B C	ES	£4.95
Kidney	Ed	Garland	B C	JX	£12
Kingdom of Hamil	Gm	Acornsoft	B C	AL	£9.95
Killer Gorilla	Gm	Program Power	B,E C	GK	£7.95
Knowledge Quest	Ed	Pee Bee	B C,D	PB	£10.95, £14.45
Konexion	Gm	M and M Software	A,B C	MM	£5
Kopfjäger	Ed	Cambridge Micro	B D	CM	£15.00 + VAT
Kremlin	Gm	Doctor Soft	B C	DO	£6.95
Kubla Khan	Gm	Blue Moon	B C	BM	£8.95
Labyrinths of La Coshe	Gm	Program Power	B C	GK	£7.95
Ladder Maze	Gm	Superior	B C	SE	£6.95
Landfall	Gm	Virgin Games	B C	VG	£7.95
Language Tutor	Ed	Rainbow Research	B C	RR	£5.00
La Princesse (French)	Ed	Aztec S/W	B C	IB	£6.50
Language-Lab	Ed	M and M Software	A,B C	MM	£7.50
Landfall & Serpent	Gm	GT Software	B C	JW	£6.50
Laser Command	Gm	Program Power	B,E C	GK	£7.95
Laser Letters	Ed	Shards	B C,D	SH	£6.95, £9.95
Laser Zone	Gm	Salamander	B C	SA	£7.95
Las Vegas	Gm	R.H. Electronics	B C	RH	£8.95
Launching Logic	Ed	Shiva	B C	SV	£14.95
Learn Addition	Ed	ABC Primary	B C	AB	£6.50
Learn Subtraction	Ed	ABC Primary	B C	AB	£6.50
Leap Frog	Gm	IJK Software	B C	IJ	£7.50
Learning Compendiun I	Ed	Ega Beva	B C	EB	£11.95
Learning Compendiun II	Ed	Ega Beva	B C	EB	£9.95
Ledger	Bs	Micro Aid	B C	IZ	£7.95
Letters	Ed	Chalksoft	B C	CH	£6.95
Let's Count	Ed	A.S.K	B C	AK	£9.95
Librarian/Word Finder	Ed	Heinemann	B C	HE	£9.25 + VAT
Library Classification	Ut	Aztec	A,B C	AZ	£6.50
Library Dewey Classification	Ed	Aztec S/W	B C	IB	£6.50
Life	Gm	Ixion	A,B C	IN	£4.75
Life Plus	Gm	Mayday	A,B C	IX	£4.49
Lift	Ed	Cambridge Micro	B D	CM	£15.00 + VAT
Lift off with Numbers	Ed	Shiva	B C	SV	£14.95
Lightpen Colourgraphic	Ut	R.H. Electronics	B C	RH	£9.95
Linear Programming	Bs	Micropax	B C	MP	£12.95
Linear Regression, Correlation	BS	Micorpax	B C	MP	£7.95
Lines and Angles	Ed	4MAT	B C	FM	£5
Link-4-Plus	Gm	ABC Software	A,B C	KR	£6.95
Lisp	Ut	Acornsoft	B,E C	AL,	£16.85, £16.10
Lisp	Ut	Aztec	B C	AZ	£16.85
Logo-Forth	Ut	H.C.C.S.	A,B E	HC	£59.00
Logo 2	Ut	Computer Concepts	B C	GJ	£10.00
Longitudinal Waves	Ed	Heinemann	B C	EH	£12.50
Looking at Graphs	Ed	Heinemann	B C	HE	£9.25 + VAT
Looking at Scales	Ed	Heinemann	B C	HE	£9.25 + VAT
Look it up	Ed	GED Software	B C	GD	£4.50
Lorry/Farm	Ed	Primary	B C,D	PP	£5.95, £7.95
Lords of Time	Gm	Level 9	B C	CU	£9.90
Lost City	Gm	Superior Software	B C	SE	£7.95
Lost In Space	Gm	Salamander	B C	SA	£9.95
Lunar Rescue	Gm	Alligata	B C	AG	£7.95
L Trap	Gm	Gem	B C	GM	£8.50
Lunar Lander	Gm	A&F Software	B C	GE	£6.90
Mach 1	Ut	Gnomonica	B E	GN	£39.95
Magic Adventure	Gm	Kansas	B C	KA	£8.50
Mailer	Ut	ASD Ltd	B C	AS	£5.75
Mailing List	Bs	Gemini	B C	GM	£19.95
Mailing	Bs	Micro-Aid	A,B C	IZ	£7.95
Mailing System	Bs	Acornsoft	B D	AL	£24.95
Map Rally	Ed	Bourne	B,E CD	BO	£8.97, £10.98
Making Ends Meet	Ed	Cambridge Micro	B C,D	CM	£15.00 + VAT
Manage	Gm	Cases	B C	CE	£6.95
Mansion Murders	Gm	Challenge Games	B C	CG	£6.95
Mapping Skills	Ed	Heinemann	B C	HE	£9.25 + VAT
Mark Book	Ed	Carvells	A,B C	CA	£5
Mark Book	Ed	BBC	A,B C	KB	£15
Martian Attack	Gm	Micropower	B C		£7.95
Masterbard Hamlet	Ed	Sulis	B C	SU	£12.95
Master Copier	Ut	Aztec S/W	A,B C	IB	£6.50
Masterfile	Ut	Beebug	B CD	BE	£10.00, £19.00
Mastermind	Gm	Micro Power	A,B C	GK	£3.95
Matchup	Ed	Edsoft	B C	ES	£5.95
Maths Invaders	Ed	Stell	B C	ST	£7.95
Maths Man	Ed	GED Software	B C	GD	£4.00
Maths Pack	Ed	Ega Beva	B C	EB	£11.95
Maths Pack	Ed	Dial	B C,D	DL	£4.95, £6.50
Maths Topics 1	Ed	Cambridge Micro	B C,D	CM	£13.95 + VAT
Maths Topics 2	Ed	Cambridge Micro	B C,D		£15.00 + VAT
Mathspell	Ed	Diamondsoft	B C	DS	£7.95
Maths Topics 1	Ed	CUP	B C	UP	£18
Maths Translation	Ed	Corona S/W	B C	JY	£6.00
Maths Tutors, Graphs	Ed	Salamander	B,E C	SA	£9.95
Maths Tutors, Vectors	Ed	Salamander	B,E C	SA	£14.95
Matching	Ed	Clares	A,B C	CL	£5.95
Maze Invaders	Gm	Micro Power	B C	GK	£4.95
Maze Man	Gm	C J E Microcomputers	B C	NV	£6.00
Micro Budget	Do	Micro Power	A,B C	GK	£6.95
Meditor	Ut	MED	B C	MD	£9.50
Medmon	Ut	MED	A,B C	MD	£9.95
Membership Manager	Do	Acornsoft	B C	AL	£9.95
Memocalc	Bs	Microaid	B C	IZ	£9.95
Mental Arithmetic Tests	Ed	Small School	B C	SM	£6.95
Mercy Mission to Mars	Gm	D.A.C.C.	B C	DC	£5.95
Merlins Castle	Ed	Pumpkin	B C	PU	£5.00
Meteors	Gm	Acornsoft	B,E C	AL	£9.95
Metrics (5)	Ed	Chalksoft	B C	KT	£9.95
Microbial Pop. Dynamics	Ed	Microwave NW	B C	MW	£7.00

Micro Man	Gm	Pro S/W	B	C	LD	£8.00
Micro Maths	Ed	LCL	A,B	C	KA	£24.50
Micros in Classroom 1-5	Ed	Longman	B	C,D	LM	£20.00 each
Middle Kingdom	Gm	Pro Software	A,B	C		£7.95
Microtext	BS	Acornsoft	B	C	AL	£49.85
Microtype	Ed	Kansas	B	C	KA	£12.50
Micros in Maths Classroom	Ed	Longman	B	C,D	LM	£26.00 +VAT
Million Mazes	Gm	Ludinski	B,E	C	KA	£6.50
Mined Out	Gm	Quicksilva	B	C	QS	£6.95
Miner	Gm	Ixion	B	C	IN	£6.90
Minefield	Gm	Eduquest	A,B	C	NW	£5.95
Minefield	Gm	A&F Software	A,B	C	GE	£6.00
Missile Base	Gm	Acornsoft	B	C	AL,	£9.95
Missile Control	Gm	C J E Microcomputers	B	C	NV	£9.00
Missing Signs	Ed	Acornsoft	A,B	C	AL	£11.90
Missile Strike	Gm	Superior	B	C	SE	£7.95
Missing Length	Ed	Scholar	B	C,D	SC	£6.50, £8.50
Mission Impossible	Gm	Aztec S/W	A,B	C	IB	£6.50
Mitosis	Ed	Garland	B	C	JX	£15
Mixed Games	Gm	I.J.K. S/W	A,B	C	IT	£3.95
MMaths	Ed	Ed. Soft	B	C	ES	£4.95
Model A Invaders	Gm	I.J.K. S/W	A,B	C	IT	£4.95
Model B Invaders	Gm	I.J.K. S/W	B	C	IT	£6.95
Moments + Van	Ed	RJE Software	B	C	RJ	£4.95
Monaco	Gm	Alligata	B	C	SY	£7.95
Money Box	Ed	Bryants	A,B	C	HW	£4.85
Monster Maths	Ed	Shards	B	C,D	SH	£6.95, £9.95
Monster Maze	Ed	Kingfisher	A,B	C	KF	£6.90
Monsters	Gm	Acornsoft	B,E	C	AL	£9.95, £9.20
Monsters and Giants	Ed	Longman	B	C,D	LM	£9.95, £12.95
Monster Battles	Gm	Bryants S/W	B	C	HW	£4.80
Moon Mission	Gm	Superior	B	C	SE	£7.95
Moon Raider	Gm	Program Power	B,E	C	GK	£7.95
Morse Code	Ed	Philip Dodderidge	B	C	PD	£6.50
Morse Code Fun	Ed	Aztec	A,B	C	AZ	£3.00
Moving Molecules	Ed	C.U.P	B	C	CP	£13.95
Mr T's Alphabet Games	Ed	Ebury	B	C	EB	£12.95
Mt T's Measuring Games	Ed	Ebury	B	C	EB	£12.95
Mr T's Money Box	Ed	Ebury	B	C	EB	£12.95
Mr T's Number Games	Ed	Ebury	B	C	EB	£12.95
Mr T's Shape Games	Ed	Ebury	B	C	EB	£12.95
Mr T Tells The Time	Ed	Ebury	B	C	EB	£12.95
Multi-Aid	Ut	Dynabyte	A,B	C	DB	£7.95
Multifile	Bs	Bug Byte	A,B	C	BB	£25.00
Multiple Choice	Ed	Eduquest	B	C	NW	£25.00
Multiply and Divide	Ed	Cottage Soft	A,B	C	CT	£7.50
Munchyman	Gm	Micro Power	A,B	C	GK	£5.95
Music	Ed	Ed. Soft	B	C	ES	£9.95
Music	Do	B.B.C.	A,B	C	KB	£10.00
Music Editor	Ed	System	B	C	SY	£9.00
Music Maker	Gm	Rainbow S/W	A,B	C	KS	£3.50
Music Synthesiser	Ut	Bug-Byte	B	C	BB	£9.50
Music Master	Ed	Merlin	B	C	MN	£6.95
Music Processor	Gm	Quicksilva	A,B	C	QS	£14.95
Music Quiz	Do	Acornsoft	B	C	AL	£12.65
Musictools 1	Ut	Musicsoft	B	C	MS	£5.75
Musical Numbers	Ed	Bryants S/W	B	C	HW	£4.88
Musical Number Box	Gm	Bryants S/W	A,B	C	HW	£3.75
Mutant Invaders	Gm	I.J.K. S/W	A,B	C	IT	£5.95
MX 80 Type 3 Screen Dump	Ut	Software for All	A,B	C	KN	£6.95
My Mathematical Self	Ed	Heinemann	B	C	HE	£9.25 +VAT
Mystery of the Jowa Star	Gm	Shards	B,E	C	SH	£7.95
Neanderthal Man	Gm	Alligata	B	C	SY	£7.95
Negadd & Negmin	Ed	Scholar	B	C,D	SC	£7.00, £9.00
Neutron	Gm	Superior	B	C	SE	£6.95
Night Sky	Do	Bridge	B	C	BR	£9.90
Numerology	Ed	Pumpkin	A,B	C	PU	£5.00
Odds on Geography	Ed	Dial	B	C,D	DL	£4.95, £6.50
Odds on Inventors	Ed	Dial	B	C,D	DL	£4.95, £6.50
Odds on Monarchs	Ed	Dial	B	C,D	DL	£4.95, £6.50

SOFTWARE SUPPLIERS

MO Micromode
32 West End Avenue
Gatley
Cheshire

MP Micropax
38 Garrick Green
Old Catton
Norwich
NR6 7AN

MS Musicsoft
12 Fallowfield
Ampthill
Beds

MW Microwave NW
24 Belford Road
Stretford
Manchester M32 0DL

NC National Extension College
18 Brooklands Avenue
Cambridge

NP Program Direct
37B New Cavendish Street
London W1M 8JR

NR Foilkade
Dept PR14
66 Littledean
Yate
Bristol BS17 4UQ

NT Digital Fantasia
24 Norbreak Road
Norbreck
Blackpool

NU Database Software
97 Defoe Drive
Park Hill
Stoke-on-Trent

NV CJE Microcomputers
25 Henry Avenue
Rustington
West Sussex BN16 2PA

NW Eduquest
Thames Avenue
Windsor
Berkshire SL4 1QP

NX Davansoft
1 Delapoer Drive
Haverfordwest
Dyfed SA61 1HX

OA Anirog Computers
26 Balcombe Gardens
Horley
Surrey

OB Golem Ltd
77 Qualitas
Bracknell
Berkshire RG12 4QG

OC A Lane (Software)
12/316 Seaside
Eastbourne
East Sussex BN22 7RH

OE Micromail
PO Box 34
Leighton Buzzard LU7 8SJ

OF Swift Link Software
118-120 Wardour Street
London W1V 4BT

OG Odyssey Software
8 Greenbrook Avenue
Hadley Wood
Barnet
Herts EN4 0LS

OH Edu-CAL
28 Ingersoll Road
Shepherds Bush
London W12 7BD
01 743 1579

OI OIC Ltd
15 Burglead Close
College Town
Camberley
Surrey GU15 4XL

OP Optima Software Ltd
36 St. Petersgate
Stockport SK1 1HL

OT Oxley Tutors
19 Tudor Walk
Watford
Herts
WD2 4NY

PB Pee Bee Software
PO Box 175
High Wycombe
Bucks.

PD Philip Dodderidge
4 Grange Close
Woodford Green
Essex IG8 9JS

PP Primary Programs
Claypits
Debden Road
Saffron Walden
Essex CB11 3JS

PS Psion Ltd
2 Huntsworth Mews
Gloucester Place
London NW1 6DD

PR Primasoft
2 Spinney Close
Glossop
Derbyshire

PT Postern Ltd
PO Box 2
Andoversford
Cheltenham
Glas, GL54 5SW

PU Pumpkin Programs
35 Hammerfield Avenue
Aberdeen AB1 6LL

PV Private Tutor
29 Holloway Lane
Chesham Bais
Amersham
Bucks

QS Quicksilva Ltd
Palmerston Park House
13 Palmerston Road
Southampton SO1 1LL

QT Qualitysoft
4 James Close
Bridgend
Glamorgan CF32 9SJ

RJ RJE Software
143 Montague Road
Leytonstone
London E11 3EW

RA Ratco Software
3/177 College Road
Moseley
Birmingham B13 9LJ

RH R. H. Electronics
Chesterton Mill
French's Road
Cambridge CB4 3NP

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SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
Odds on Musicians	Ed	Dial	B C,D	DL	£4.95, £6.50
Odds on Writers	Ed	Dial	B C,D	DL	£4.95, £6.50
Oblivion	Gm	Bug-BYte	B C	BB	£7.50
Old Father Time	Gm	Bug-Byte	B C	BB	£9.50
Oil	Gm	Computersmith	B C	LC	£5.50
Omega Probe	Gm	Optima	B C	OP	£8.95
One to Nine	Ed	Acornsoft	B C	AL	£9.95
1-2-3 Snap	Ed	Ega Beva	B C	EB	£11.95
Optimon	Ut	Optima	B C	OP	£9.95
Optics	Ed	Hutchinson	B C	HN	£18.40
Options	Ed	System	B C	SY	£23.00
Options Table	Ed	A. J. Vision	B C	AV	£14.95
Order Processing	Bs	Acornsoft	B D	AL	£24.95
Oscilloscope	Ed	RJE Software	B C	RJ	£6.95
Othello	Gm	Computer Concepts	A,B,EC	GJ	£8.95
Othello	Gm	Computercat	B C	CC	£8.95
Othello	Gm	Sapphire	B C	SH	£5.95
Paintbox	Ut	Beebug	B C,D	BE	£10.00, £12.00
Painter	Gm	A & F	B C	GE	£8.00
Painting	Ut	BBC	A,B C	JB	£6.0
Paras	Gm	Lothlorien	B C	LO	£6.95
Pareto Anlysis	B	Micropax	B C	MP	£7.95
Parity	Ed	N. Darwood	A,B C	JB	£10.00
Parts of a Sentence	Ed	Scholar	B C,D	SC	£5.00, £7.00
Pascal	Ed	Chalksoft	B C	KT	£5.95
Payroll	Bs	Micro-Aid	B C	IZ	£17.95
Peeko Computer	Bs	Acornsoft	A,B C	AL	£9.95, £9.20
Peggit	ED	Ed. Soft	B C	ES	£5.95
Password	Ed	MP Software	B C,D	MP	£11.00, £14.00
Pengwyn	Gm	Postern	B C	PT	£6.95
Pentiles	Ed	Silverlind	B C	SL	£6.95
Perseus and Andromeda	Gm	Digital Fantasia	B C	NT	£10.29
Personal Accounts	Do	Kansas	B C	KA	£10.50
Personal Money Management	Do	Acornsoft	B,E C	AL	£11.90, £11.50
Pete the Plastered Postman/	Gm	ASP Software	A,B C	OD	£8.50
Pharoah's Tomb	Gm	A&F Software	B C	GE	£8.00
Philosopher's Quest	Gm	Acornsoft	B C	GA	£9.95
Physics	Ed	Program Power	A,B,EC	GK	£6.95
Picture Maths	Ed	A J Visions	B C	AV	£9.95
Picfile	Ed	Cambridge Micro	B C,D	CM	£20.08
Picture Spell	Ed	GED Software	B C	GD	£5.00
Pieman	Gm	Musicsoft	B C	MS	£3.75
Pinball	Gm	Microbyte	B C	MB	£5.95
Perspective	Ut	Aztec	B C	AZ	£6.50
Picasso GS	Ut	Odyssey	B C	OG	£4.50
Picsave	Ut	Hexagon S/W	A,B C	JA	£6.00
Pick-a-Word	Ed	Ega Beva	B C	EB	£11.95
Picture Maker	Ut	Acornsoft	B,E C	AL	£9.95, £9.20
Pirate	Ed	Chalksoft	B C	CH	£9.25
Planes	Gm	A&F	B C	GE	£8.00
Planet Invaders	Gm	Merlin	B C	MN	£7.95
Planetoid	Gm	Acornsoft	B C	AL	£9.95
Plegaron People Eaters	Gm	R. H. Electronics	B C	RH	£8.95
Plotter	Ed	Dial	B C,D	DL	£6.50, £8.00
Population Growth	Ed	C.U.P.	B C	CP	£13.95
Poker Dice	Gm	Program Power	B C	GK	£5.95
Powerboat Race	Gm	Futura S/W	B C	JC	£7.95
Polaris	Gm	Bug Byte	B C	KP	£5.50
Pontoon	Gm	M and M Software	B C	M	£5
Pool	Gm	Dynabyte	B,E C	DB	£7.95
Population Growth	Ed	Cambridge Micro	B C,D	CM	£13.95 + £1.62
Procaid	Ut	Micro Aid	A,B C	IZ	£3.45
Procflush	Ut	Micro-Aid	A,B C	IZ	£1.00
Procvar	Ut	Micro-Aid	A,B C	IZ	£1.95
Proteanse	Gm	D.K. Tronics	B C	DK	£6.95
Princess	Gm	Aztec S/W	A,B C	IB	£6.50
Pub games/Picasso package	Gm	Starsoft	B C	SR	£9.95
Punc-Man	Ed	Chalksoft	B C	KT	£7.95
Punctuation	Ed	Bryants S/W	B C	HW	£4.88
Purchasing	Bs	Acornsoft	B D	AC	£24.95
Questionmaster	Ed	Hutchinson	B C	HN	£28.75
Q Bert	Gm	Superior Software	B C	SE	£7.95
Railroader	Ed	Stell	B C	ST	£7.95
Record Changer	Bs	AJ Vision	B C	AV	£19.95
Record Keeper	Ut	BBC Pubs	B C	KB	£13.80
Recover	Ut	Baksoft	A,B C	BK	£6.00
Revenge of Zopr	Gm	Kansas	B C	KA	£9.50
Reversi	Gm	Microbyte	B C	MB	£5.95
Reversi	Gm	Kansas	B C	KA	£6.25
Reversi	Gm	Silverlind	B C	SL	£6.95
Reversi 1	Gm	Program Power	A,B C	GK	£5.95
Reversi 2	Gm	Program Power	B C	GK	£5.95
Ripple Tank	Ed	RJE Software	B C	RJ	£7.95
Road Runner	Gm	Superior Software	B C	CH	£7.95
Road Safety	Ed	Bryants	A,B C	HW	£4.85
Robotic Sums	Ed	GED Software	B C	GD	£4.50
Robot	Gm	Miking S/W	B C	KC	£4.95
Rocket Raid	Gm	Acornsoft	B C	AL	£9.95
Roman Empire	Gm	Lothlorien	B C	LO	£6.95
Roulette	Gm	Program Power	A,B C	GK	£5.95
Row of Four	Gm	Software For All	B C	KN	£6.95
Royalty Quiz	Do	Acornsoft	B C	AL	£12.65
Russian Irregular Verbs	Ed	Carsondale	B C	CD	£21.00
Russian Text Fill	Ed	Carsondale	B C	CD	£11.96
Scales and Decimal Estimation	Ed	RJE Software	B C	RJ	£3.95
Science Pack	Ed	Dial	B C,D	DL	£4.95, £6.50
Science Fiction Quiz	Do	Acornsoft	B,E C	AL	£12.65
Sets and Operators	Ed	Shiva	B C	SV	£14.95
737 Simulator Flight	Gm	Salamandar	B,E C	SA	£9.95
Scramble	Gm	Bug-Byte	A,B C	BB	£6.95
Scred	Bs	Stable	B C	CS	£18
Scribe	Bs	Merlin	B C	MN	£29.95
Sea Cliff Erosion	Ed	Cambridge Micro	B C,D	CM	£15.00 + VAT
Sea Lord	Gm	Bug-Byte	B C	BB	£7.50
Sea Wolf	Gm	Optima	B C	OP	£8.95
Search for the Jewels	Gm	SJG Soft	B C	SJ	£8.95
Searchbas	Ut	Micro-Aid	A,B C	IZ	£1.95
Seed Germination	Ed	Garland Comp.	B C	JX	£18.82
Seige	Gm	Postern	B C	PT	£6.95
Sentence Maker	Ed	Arnold-Wheaton	B C	AW	£9.95 + VAT
Sequences	Ed	Chalksoft	B C	CH	£5.95
Shirley Conran's Magic Garden	Do	Acornsoft	B C	AL	£9.95
Sheepdog	Ed	Longman	B C	LM	£9.95, £12.95
Sheepdog Trials	Ed	Bryants S/W	B C	HW	£4.80
Shootout	Gm	MP S/W	B C	JZ	£5.00
Seek	Gm	Program Power	A,B C	GK	£6.95
Sentence Sequencing	Ed	Acornsoft	A,B C	AL	£11.90
Sentence Shaker	Ed	GED Software	B C	GD	£4.50
747	Gm	Doctor Soft	B C	DO	£7.95
747	Gm	D.A.C.C.	B C	DC	£9.95
Shadowfax	Gm	Postern	B C	PT	£6.95
Shape Generator	Ut	Software for All	B C	KN	£11.50
Shapes Package	Ed	GED Software	B C	GD	£8.00
Shape Snap	Ed	Ega Beva	B C	EB	£11.95
Shopping	Ed	GED Software	B C	GD	£4.50
Shrinking Professor	Gm	A & F	B C	GE	£8.00
Shuttle	Gm	Molimerx	B C	MX	£14.95
Signs	Ed	Acornsoft	A,B C	AL	£11.90
Simple Word Processor	Ed	A J Vision	B C	AV	£9.95
Simple Queues	BS	Micropax	B C	MP	£7.95
Simulation-Surgery	BS	Micropax	B C	MP	£12.95
Simulation-Carlton Trucks	Bs	Micropax	B C	UP	£12.95
6502 Development System	Ut	Acornsoft	B D	AL	£49.85
Skwosh	Gm	Miking S/W	B C	KC	£3.95
Sliding Block Puzzles	Gm	Acornsoft	B C	AL	£9.95

Sliding Block Puzzle	Ed	Ega Beva	B	C	RB	£9.95
Ski Slalom	Gm	R. H. Electronics	B	C	RH	£8.95
Slicker Puzzle	Gm	D. K. Tronics	B	C	DK	£6.95
Snail Trail	Gm	R. H. ELectronics	B	C	RH	£4.95
Snake	Gm	Kansas	B	C	KA	£8.50
Snake	Gm	Computer Concepts	B	C	GJ	£6.67
Snake Pit	Gm	Postern	B	C	PT	£6.95
Snapper	Gm	Acornsoft	B,E	C	AL	£9.95, £9.20
Snig	Gm	Computercat	B	C	CC	£6.75
Snooker	Gm	Visions	B	C	VI	£8.95
Snooker	Gm	Acornsoft	B	C	AL	£9.95
Snorter	Gm	Beebug	B	C	BE	£7.50
Snowball	Gm	Level 9	B	C	CU	£9.90
Sort M/C	Ut	Micro-Aid	A,B	C	IZ	£1.00
Sortbas	Ut	Micro-Aid	A,B	C	IZ	£1.00
Soundplan	Ut	ME & P Products	A,B	C	KK	£10.00
Spacehawks	Gm	Computer Concepts	B	C	GJ	£7.80
Space Adventure	Gm	Virgin Games	B	C	VG	£7.95
Space Cab	Gm	Kansas	B	C	KA	£7.25
Space Fighter	Gm	Superior Software	B	C	SE	£7.95
Space Invaders	Gm	Bug-Byte	B	C	BB	£5.50
Space Pirates	Gm	Bug-Byte	A,B	C	BB	£5.50
S-Pascal	Ut	Acornsoft	B,E	C	AL	£16.85, £16.10
Spacex	Ed	4MAT	B	C	FM	£10.00
Spaceguard	Gm	MP Software	B	C	MP	£6.50
Space Hi-way	Gm	Amcom	B	C	AO	£7.45
Space Kingdom	Gm	Software For All	B	C	KN	£7.95
Space Maze	Gm	Program Power	B	C	GK	£7.95
Spacefight	Gm	Miking S/W	B	C	KC	£7.95
Space Warp	Gm	Bug Byte	B	C	BB	£11.50
Space Fighter	Gm	MP S/W	B	C	JZ	£8.50
Space Fighter	Gm	Superior S/W	B	C	KH	£7.00
Space Games Pack 1	Gm	Futura S/W	A,B	C	JC	£3.99
Space Games Pack 2	Gm	Futura S/W	A,B	C	JC	£3.99
Space Games Pack 3	Gm	Futura S/W	A,B	C	JC	£4.99
Space Games Pack 4	Gm	Futura S/W	A,B	C	JC	£4.99
Space Ranger	Gm	Microbyte	B	C	MB	£7.95
Space Trek	Gm	Program Direct	B	C	NP	£5.99
Space Pirates	Gm	Bug Byte	A,B	C	KP	£8.00
Speechparts	Ed	Bryants S/W	B	C	HW	£4.88
Speed and Light	Ed	Acornsoft	A,B	C	AL	£11.90
Spellcheck (Wordwise)	Ut	Beebug	B	D	BE	£19.00
Spell 7/Spell 9+	ED	Primary Programs	B	C	PP	£3.95
Spelltest	Ed	Bryants	A,B	C	HW	£4.85
Spellings	Ed	ECL	B	C	EL	£5.99
Sphinx Adventure	Gm	Acornsoft	B	C	AL	£9.95, £9.20
Spreadsheet	Ed	Contex	B	C	CX	£7.99
Sprites	Ut	Beebug	B	C,D	BE	£10.00, £12.00
Spy	Ut	System	B	C	SY	£24.15
Squash	Gm	Aztec S/W	A,B	C	IB	£5.50
Standards and Variances	Bs	Micropax	B	C	MP	£7.95
Starbattle	Gm	Kudusoft	B	C	KU	£5.50
Starlander	Gm	Kudusoft	A,B	C	KU	£3.50
Star Patrol	Gm	Kudusoft	B	C	KU	£6.50
Starship Command	Gm	Acornsoft	B,E	C	AL	£9.95, £9.20
Star Trader	Gm	FBC Systems	B	C	FB	£9.50
Starfighter	Gm	FBC Systems	B	C	FB	£7.50
Star Trek Adventure	Gm	Superior Software	B	C	SE	£7.95
Star Trek	Gm	Program Power	A,B	C	GK	£5.95
Star Maze	Gm	Database Software	B	C	NU	£7.50
Star Patrol	Gm	Kudusoft	B	C	KU	£6.50
Startrek/Candy Floss	Gm	I.J.K. S/W	A,B	C	IT	£5.95
Star Trek	Gm	Hexagon S/W	A,B	C	JA	£5.50
Statpack	Ed	Micro-Aid	B	C	IZ	£9.95
Starter Word Splits	Ed	Sulis	B	C	SU	£9.95
Stock Control	Bs	Acornsoft	B	D	AL	£24.95
Stock Control	Bs	Gemini	B	C	GM	£19.95
Stock Control, classification	BS	Micropax	B	C	MP	£7.95
Stock Control-EOQ	BS	Micropax	B	C	MP	£7.95
Stock Control-Roq and Rol	Bs	Micropax	B	C	MP	£7.95
Story 'A'	Ed	Chalksoft	B	C	KT	£6.95
Story A — Spanish Gold	Ed	Chalksoft	B	C	CH	£7.95
Storybuilder	Ed	Bryants S/W	B	C	HW	£4.85
Stock Valuation	Bs	Micropax	B	C	MP	£7.95
Stock	Ed	System	B	C	SY	£14.95
Stats 1	Bs	ME & P Products	A,B	C	KK	£15.00
Subkiller	Gm	D.K. Tronics	B	C	DK	£6.95
Submarines	Ed	GED Software	B	C	GD	£4.00
Suffixes	Ed	Golem	B	C	OB	£8.05
Super Fruits	Gm	D. K. Tronics	B	C	DK	£6.95
Super Invaders	Gm	Acornsoft	B	C	AL	£9.95
Superlife	Ed	Golem	B,E	C	OB	£6.90
Superplot	Ut	Beebug	B	C	BE	£10.00
Super Spell	Ed	Aztec	A,B	C	AZ	£5.50
Supergolf	Gm	Squirrel Software	B	C	SS	£7.50
Super Hangman	Gm	I.J.K. S/W	B	C	IT	£3.95
Survival	Ed	System	B	C	SY	£14.95
Survivor	Gm	MP Software	B	C	MP	£6.50
Swamp Monsters	Gm	M P Software		C	JZ	£6.50
Tables Test	Ed	Bryants S/W	B	C	HW	£4.88
Tables	Ed	Bryants	A,B	C	HW	£4.85
Tables	Ed	ECL	B	C	EL	£5.99
Table Sums	Ed	Griffin	B	C	GR	£9.95
Tabel Adventures	Ed	A.S.K	B	C	AK	£9.95
Tank Attack	Gm	Gem Software	B	C	GC	£7.95
Tanks	Gm	Salamandar	B	C	SA	£7.95
Tape Copy	Ut	Davansoft	A,B	C	NX	£7.50
Taxcalc	Ut	BBC Pubs	B	C	KB	£17.25
Teacher's Toolkit	Ed	Wida Software	B	C	FY	£30.00

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RO *Romik Software*
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SC *Scholar Soft*
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Woolsington Gdns
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SF *Softspot*
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Edinburgh Building
Shaftesbury Road
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VI *Visions Software*
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London W11 3DD

WI *5 Belmont Avenue*
Edmonton
London N9 7JL

CONTINUED OVER

SOFTWARE LISTINGS

Title	Type	Manufacturers	Memory	Software Supplier	Price
Teletext Pack	Ut	Beebug	B C,D	BE	£10.00, £12.00
Ten Little Indians	Gm	Digital Fantasia	B C	NT	£10.29
Tense French	Ed	Sulis	B C	SU	£9.95
Tessalations	Ed	Cambridge Micro	B D	CM	£25.00 + VAT
Text Grader	Ed	Hutchinson	B C	HN	£28.75
Text Print Extension	Ut	Ratco Soft	A,B C	RA	£2.00
Text Processing Pack	Bs	Eduquest	B C	NW	£10.00
Theatre Quiz	Do	Acornsoft	B,E C	AL	£12.65
The Frog	Gm	James Hager	B C	IV	£6.50
The Golden Baton	Gm	Digital Fantasia	A,B C	NT	£8.95
3-D Mouse Maze	Gm	Rainbow S/W	B C	KS	£3.50
3-D Maze	Gm	Hexagon S/W	A,B C	JA	£6.00
3D Maze	Gm	Earthshock S/W	A,B L	KI	£3.00
3D Maze	Gm	I.J.K. S/W	B C	IT	£3.95
The Basic Lesson	Ed	Ega Beva	B C	EB	£11.95
The Computer Programme Programs Vol 2	Do	B.B.C	B C	KB	£10.00
The Computer Programme Programs Vol 1	Do	B.B.C.	A,B C	KB	£10.00
The Golden Baton	Gm	Digital Fantasia	A,B C	NT	£10.29
The Graphics Lesson	Ed	Ega Beva	B C	EB	£11.95
The Generators	Gm	Quicksilva	B C	QS	£6.95
The Lemming Syndrome	Gm	Dynabyte	B,E C	DB	£7.95
The Frog	Gm	Software For All	B C	KN	£7.95
The Guns of Navarone	Gm	D.A.C.C.	B C	DC	£7.95
The Theorem of Pythagoras	Ed	Small School	B C	SM	£6.95
The Ring of Time	Gm	Kansas	B C	KA	£9.50
The Typing Master	Do	Anthony Ashpitel	B C	AA	£20.00
The Wizard of Akyrz	Gm	Digital Fantasia	B C	NT	£10.29
The Garden	Ed	Clares	A,B C	CL	£6.95
The Time Machine	Gm	Digital Fantashia	A,B C	NT	£8.95
There	Ed	Golem	B C	OB	£8.05
3-Deep Space	Gm	Postern	B C	PT	£7.95
3D-Tankzone	Gm	Dynabyte	B C	DB	£7.95
Time	Ed	Stell	B C	ST	£7.95
Timeman Two	Ed	Bourne	B,E C	BO	£8.97
Timeman One	Ed	Bourne	A,B,EC	B	£8.97, £10.98
Time Series Analysis	Bs	Micropax	B C	MP	£7.05
Timetabling OPT 1-6	Ed	Hutchinson	B C	HN	£17.25
Timetabling TT 1-6	Ed	Hutchinson	B C	HN	£17.25
Time Traveller	Ed	Sulis	B C	SU	£9.95
Timetrek	Gm	Micro Power	B,E C	GK	£6.95
Tiny Pascal	Ut	H.C.C.S.	A,B E	HC	£59.00
Titrations	Ed	System	B C	SY	£14.95
Toolbox	Ut	BBC Pubs	B C	KB	£21.00
Toolkit	Ut	Beebug	B E	BE	£27.00
Touch Typist	Ed	Computercat	B C	CC	£9.95
Touch Type Tutor	Ed	Technical Education	A,B C	TE	£4.95
Towering Inferno	Ed	Sulis	B C	SU	£9.95
Tower of Alos	Gm	A&F Software	A,B C	GE	£6.90
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Towns of Britain	Ed	Aztec S/W	A,B C	IB	£6.50
Towntest	Ed	Silverlind	B C	SL	£6.50
3-D Ice Hockey	Gm	Computersmith	B C	LC	£5.50
3 in 1	Gm	R. H. Electronics	A,B C	RH	£7.50
Trafalgar	Gm	Squirrel Software	B C	SS	£8.00
2002	Gm	Superior Software	B C	SE	£7.95
Trailblazer	Ed	Arnold-Wheaton	B C	AW	£12.95 + VAT
Tramix	Gm	D. K. Tronics	B C	DK	£6.95
Tree of Knowledge	Ed	Acornsoft	A,B,EC	AL,	£9.95
Transistors Revenge	Gm	Soft Spot	B C	SF	£6.95
Triangles/Regular Shapes	Ed	Primary Programs	B C	PP	£3.95
Tripute	Gm	Dial	B C,D	DL	£4.95, £6.50
Twenty Crosswords	Gm	NEC	B C	NC	£6.90
Turtle Graphics	Ed	Acornsoft	B C	AL	£16.85, £16.10
Type Easy	Ed	Carswell	B C	CR	£8.95
Type Invaders	Ed	Carswell	B C	CR	£6.95
Typing Tutor	Ed	Contex	B C	CX	£9.99
Ultima-File	Dm	Ixion	A,B C	IN	£7.50
Ultracale	Bs	BBC Publications	B R	KB	£74.95
Unima	Gm	Dial	B C,D	DL	£3.95, £5.50
Utilities Package	Ut	Salamander	B C	SA	£9.95
Unoriginal Games	Gm	McKeran	A,B C	MK	£2.00
Util-1	Ut	Gem Software	B C	GC	£9.95
Utility Pack	Ut	Computersmith	B C	LC	£5.50
Utilities	Ut	Qualitysoft	A,B C	QT	£4.00
Utilities	Ut	ASD Ltd	B C	AS	£5.75
Utilities	Ut	Golem	A,B,EC	OB	£5.95
Utility A	Ut	Micro-Aid	A,B C	IZ	£5.95
Utility Pack	Ut	Ega Beva	B C	EB	£7.95
Vader Raid	Gm	FBC Systems	B C	FB	£7.50
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Views/Faces	Ed	Primary Programs	B C	PP	£3.95
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Vocab	Do	Beebug	B C	BE	£10.00
Vogon Attack	Gm	Micromail	B C	OE	£6.33
Vortex	Gm	Software Invasion	B C,D	15	£7.95, £11.95
Vu-calc	Bs	Psion	B C	PS	£14.95
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Vu-type	Ed	BBC Pubs	B C	KB	£16.10
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Watts in Your Home	Ed	Cambridge Micro	B C,D	CM	£13.95 + £1.62
Whatsit	Ed	Ed. Soft	B C	ES	£4.95
What's it Worth?	Ed	Arnold-Wheaton	B C	AW	£10 + VAT
Where?	ED	Primary Programs	B C	PP	£3.95
Where?	Ed	Program Power	B,E C	GK	£6.95
White Knight Mark Eleven	Gm	BBC Pubs	B C	KB	£11.50
Whitewash	Gm	Amcom	B C	AO	£5.95
Whole Number Arithmetic	Ed	RJE Software	B C	RJ	£7.95
White Barrows Conquering Everest	Gm	ASP Software	A,B C	AS	£11.45
Wizard	Gm	Quicksilva	B C	QS	£6.95
Wolfpack	Gm	Doctor Soft	B C	DO	£7.95
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Wordmaster	Ed	Sulis	B C	SU	£9.95
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Word Processor	Bs	Gemini	B C	GM	£19.95
Wordprocessor	Ut	ASD Ltd	A,B C	AS	£5.75
What's Your Reason?	Ed	Arnold-Wheaton	B C	AW	£10 + VAT
Wordscan	Gm	Dial	B C,D	DL	£6.50, £8.00
Word Sequencing	Ed	Acornsoft	A,B C	AL	£11.90
Wordspell	Ed	Griffin Software	B C	GR	£9.95
Words, Words, Words	Ed	A.S.K	B C	Ak	£9.95
Wordsworth	Ut	Ian Copestake	B C	IC	£17.25
Wordy	Ut	Odyssey	B C	AS	£5.75
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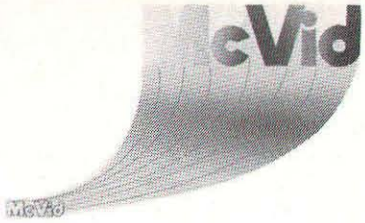
Wordy	Ut	Odyssey	B C	OG	£4.50
Worded	Ed	Processor Applications	B C	AP	£5.95
Wordpro	Bs	IJK Software	B C	IT	£10.50
Wordscan	Bs	Dial	B C	AD	£12.00
World Geography	Ed	Program Power	B C	GK	£6.95
World Geography	Ed	4MAT	B C	FM	£10.00
Xanagrams	Gm	Postern	B C	PT	£6.95
Zarm	Gm	Micropower	B C		£7.95

Machine Code graphics routines for the BBC MICRO A&B, ELECTRON



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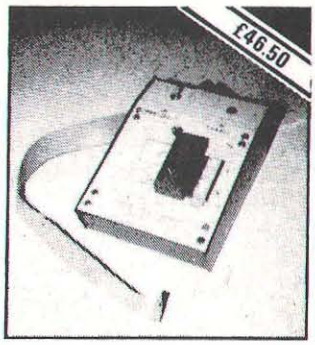

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Club Corner

It's easy to feel you are alone when you are sitting in front of your micro wondering why it won't do what you think you've instructed it to do! But you need never be alone again. User groups are springing up all over the place and can be an invaluable source of help, enjoyment and inspiration.

We list here some of the clubs that particularly welcome BBC and Electron owners. If you don't see one in your area, why not start one up and let us know. Please remember however that this list is by no means comprehensive.

Join forces, merge resources. Choose from BBC and Electron clubs around the country.

RADIO AMATEUR MICRO USER GROUP

A new group has been formed for radio amateurs who use their BBC Micros within the hobby. It is intended that meetings will be held on a bi-monthly basis in East London. There will also be a 'net' on 145.200 Mhz. (S.8) on Friday evenings at 1930 hours local time.

Future meetings at The Design Block, Eastlea School, Hilda Road, Canning Town, London E16 will be on 10 July (demo on database and log keeping in Amateur Radio), 11th September and 6th November.

The cost of membership will be £2.00 per annum and all enquiries should be sent, enclosing SAE to: The Secretary, R.A.M.U.G., C/o R.A. Webb, 39 Aldworth Road, Stratford, London E15 4DN.

KINGS LYNN AND WEST NORFOLK BBC MICRO USER GROUP

Norfolk College of Arts and Technology,
Tennyson Avenue,
Kings Lynn.
Tel: 61144 ext. 323

CATERHAM LEISURE CENTRE COMPUTER CLUB

Caterham Leisure Centre,
Godstone Road,
Caterham,
Surrey CR3 6RE.
Tel: Caterham 48304
(M Goldsbrough) or
Caterham 43316 (J Hodges)
Contact: M Goldsbrough
(Centre Manager) or J Hodges

The club has started at the Leisure Centre which has a Model B BBC Micro available. Meetings are on Thursday nights at 8.00 pm and new members (and their micros) are welcome to come along.

THE FAREHAM AND PORTSMOUTH AMATEUR COMPUTER CLUB

23 Sandy Close,
Petersfield,
Hants GU31 4HF.
Tel: 0703 4059 (evenings)
Contact: Peter Smith

Established back in 1980, the Fareham and Portsmouth Amateur Computer Club have recently organised a referral service and a Users Club for the BBC Micro. The group meet at 7.00 pm on the third Monday of each month at the Portchester Community Centre.

BBC NORWAY

O-Inform
PO Box 716
N3191 Horten
Norway

The Scandinavians have shown great interest in the BBC micro along with most of Europe. In Norway Oivind Grenness has decided to set up a club. Contact him at the above address.

PRESTON BBC USER GROUP

8 Briar Grove
Ingol
Preston PR2 3UR
Contact: Mr D. Coulter

POTBUG BBC USERS GROUP

8 St George's Avenue
High Lane
Tunstall
Stoke-on-Trent
Tel: 818499
Contact: Mr M. G. Forster

WEST HERTS 80 USERS ASSOCIATION

St. Stephens Parish Centre
Station Road
Bricketwood

The West Herts 80 Users Association has decided to start a BBC unit sub group. This will allow them to maintain bulk purchase schemes and membership of the BBC computer literacy scheme of which the Association is a member.

As an Association, with a constitution, bank account, regular premises and organisational experience, the unit can offer a service to BBC users who want their own club.

R. C. Smith, the Herts Association secretary, tells us that the present venue is just off the A405 near St. Albans, within easy access of the A5, M1, M10 and A1.

The present membership comes from the local area of Hemel Hempstead, Tring, St. Albans, Watford, Hatfield and from as far away as Ware, Loughton in Essex, Slough and Uxbridge. They also have a few Londoners for good measure.

NORWICH & DISTRICT BBC MICRO USER GROUP

Department of Electronics
Norwich City College,
Ipswich Road,
Norwich NR2 2LJ
Tel: 0603 60011 ext 231
Contact: Paul Beverley

Meetings are held at Norwich City College twice a month during term time. On the first Tuesday of each month a visiting speaker takes part. On November 1st Mr Chris Pointeer and Mrs Diana Thomson survey educational software. On the third Tuesday of each month there is a workshop. All meetings take place at 7.00pm. The first session is free, thereafter you pay the subscription of £3.00 (students and OAPs £1.50).

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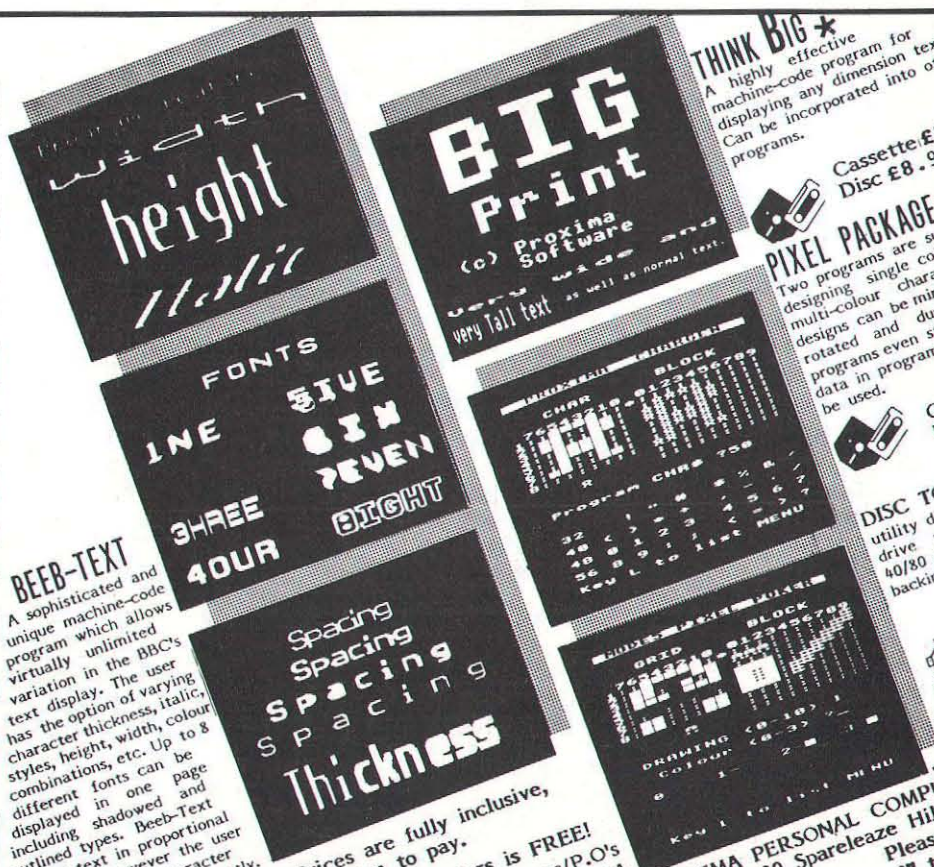

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Machine Code Capers

Peter Voke

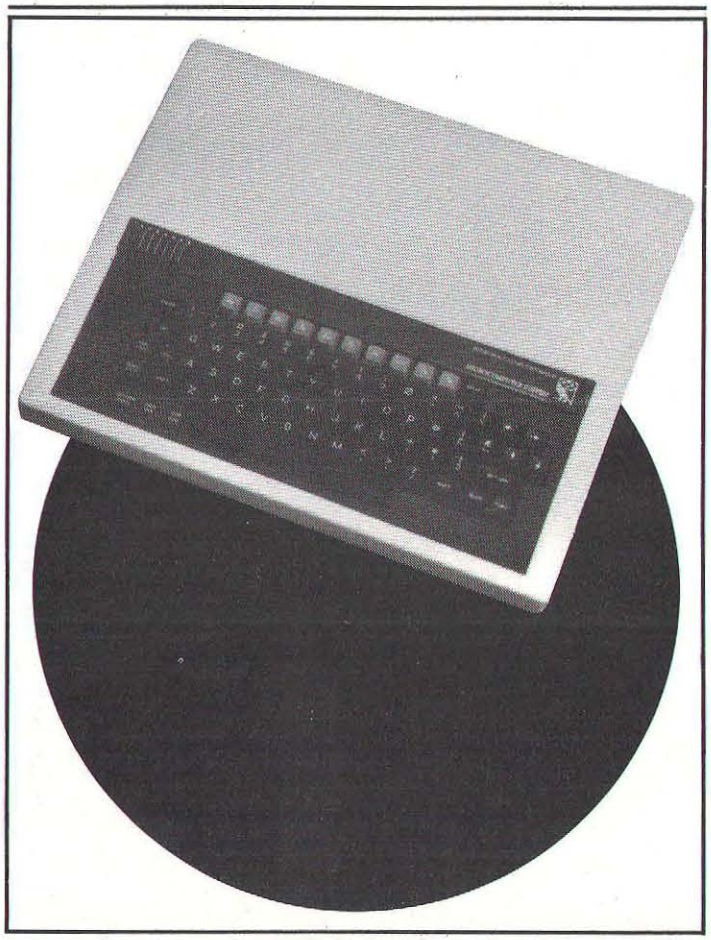
Coding a Circle command can be a tricky business.

The BBC micro lacks a circle drawing routine in its BASIC, in spite of the wealth of other powerful commands. Plenty of people have wanted one, and it is not too difficult to write a BASIC subroutine that can do the job.

In machine code it is a different matter. The main reason is that the obvious way of drawing a circle, or any more general curve like an ellipse, involves using sines and cosines. There is another way, equally accurate, based on the famous theorem of Pythagoras, but that involves using the square root function. All very well in BASIC, but how can you calculate sines, cosines or square roots in machine code?

It is possible, of course, since the BASIC interpreter is doing it in machine code, on the BBC micro or any other computer. But calling BASIC routines from your own machine code is very difficult — impossible unless you know the 'entry points' of the appropriate routines, and exactly what they do — and also risky since the entry points differ in the various issues of the BASIC interpreter ROM.

Unless you are a real expert, you will not want to call BASIC routines or write your own sine and cosine or square root calculating routines, to say nothing of the multiplication that is also needed. And all to draw a simple circle, so easy in BASIC!



TRICKY

One solution is to use a simple 'trick' program that draws reasonable circles provided they are not too small, without using sines or cosines at all. Try program 1. I have discussed a very similar program to this in a previous issue of ***A&B Computing.*** (Incidentally, if any teachers are reading this, the question of just why program 1 draws a circle might make an interesting sixth form discussion.)

The procedure PROCc is used as follows: A% is the radius, X% is the x position of the centre, and Y% the y position of the centre, all in normal graphic coordinates but divided by 4 in every case. Since no special functions like sines, cosines, square roots and so on are involved, it should be possible to rewrite program 1 in machine code.

However, there are some problems. First, there is some division: but notice that I have chosen to divide by 16 (though another number would do) because this is easy in machine code using the assembly language mnemonic LSR A.

Second, and more difficult, the values of A% and B% become negative in the course of the drawing of the circle. Negative numbers in machine code are represented by bytes greater than 127 (&7F), or bytes in which the top bit is 1. This is called the 'two's complement' method of writing negative numbers; for instance −1 is represented by the byte &FF (127).

In fact the two's complement method works fine for the machine code version of the circle drawing routine — except that odd things happen if the circle hits the edge of the screen, and the two's complement negative numbers have to be treated in a special way to divide them by 16.

Apart from this, the machine code version follows the BASIC fairly closely. Program 2 assembles the code and then calls it. The assembly language is in the long procedure PROCassemble. Again A% is the radius, X% and Y% are the coordinates of the centre, all in graphics coordinates divided by four. From machine code, the appropriate values are simply put into the A, X and Y registers, and CIRC is called by JSR CIRC.

Two subroutines are used, which I have called LIMO and NEGAT. LIMO performs the equivalent of the BASIC PLOT statement, and hence is capable of drawing and filling triangles as well as doing the simple MOVE and DRAW (PLOT 4 and PLOT 5) it is used for here.

LIMO is used like this: if the PLOT statement in BASIC is PLOT 5,100,200 then the line
A% = 5: X% = 25: Y% = 50: CALL LIMO
will do the same thing. Notice that X% and Y% are a quarter of the values used in the normal PLOT statement; this is so that they fit into one byte, and it means you cannot draw in a fairly wide strip down the right hand side of the screen.

From machine code, of course, it is just
LDA #5
LDX #25
LDY #50
JSR LIMO.

The other subroutine, NEGAT, is the one used to divide the two's complement negative numbers by 16. It does this by finding the absolute, or positive, value of the number, dividing that by sixteen, and switching its 'sign' back to negative. Straightforward, if a little cumbersome.

The main part of the assembly language follows the BASIC fairly closely. Overall the machine code is almost exactly the same length as program 1, including the first part that sets up A%, X% and Y% and calls the procedure. It is quite a bit longer than PROCc alone — but then drawing circles is difficult in machine code, and the machine code does include the subroutine LIMO, which may be useful in its own right. Program 2 has a long way to go in terms of quality, especially for smaller circles, and the circles cannot overlap the edges of the square screen without appearing at the opposite edge: but any improvements I shall have to leave to you.

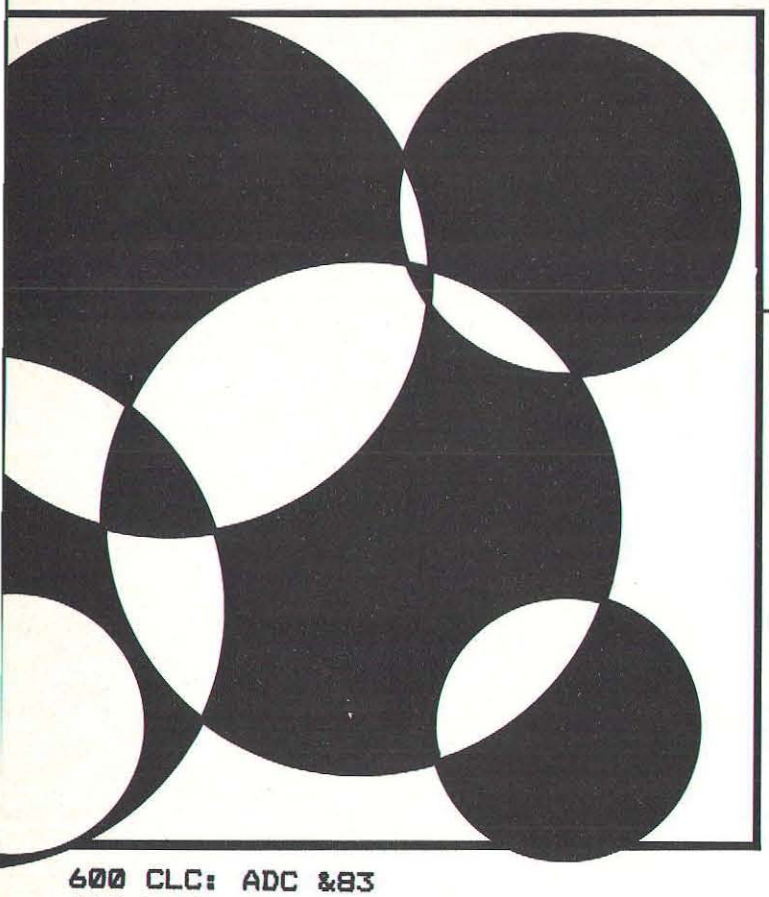
CONTINUED OVER

PROGRAM LISTING 1

```
 10REM PROGRAM CIRC1
 20MODE4
 30A%=100
 40X%=120
 50Y%=120
 60PROCc(A%,X%,Y%)
 70END
 80
 90DEFPROCc(A%,X%,Y%)
100B%=0
110MOVE (X%+A%)*4,Y%*4
120FORI%=1TO255
130A%=A%+B%DIV16
140B%=B%-A%DIV16
150DRAW(X%+A%)*4,(Y%+B%)*4
160NEXT
170ENDPROC
```

PROGRAM LISTING 2

```
 10 REM PROGRAM CIRC2
 20
 30 PROCassemble
 40 MODE4
 50 A%=100:X%=120:Y%=120
 60 CALL &C00
 70 END
 80
 90 DEFPROCassemble
100
110 OSASCI=&FFE3
120 FOR O%=0TO3 STEP3
130 P%=&C00
140
150 [ OPT O%
160
170 .CIRC
180 \ store A, B, X and Y
190 STA &80
200 LDA #0: STA &81
210 STX &82
220 STY &83
230
240 \ move to starting point
250 TXA
260 CLC: ADC &80
270 TAX
280 LDA #4
290 JSR LIMO
300
310 \ set up the loop counter
320 LDA #255
330 STA &89
340
350 .LOOP
360
370 \ divide B by 16,
380 LDA &81
390 BPL C1
400 JSR NEGAT: JMP C2
410 .C1
420 LSR A: LSR A: LSR A: LSR A
430 .C2 \ ...and add it to A
440 CLC: ADC &80
450 STA &80
460
470 \ divide A by 16,
480 BPL C3
490 JSR NEGAT: JMP C4
500 .C3
510 LSR A: LSR A: LSR A: LSR A
520 .C4 \ ...subtract B from it,
530 SEC: SBC &81
540 \ ...and reverse sign
550 STA &81
560 LDA #0: SEC: SBC &81
570 STA &81
580
590 \ add centre coordinates
```



```
600 CLC: ADC &83
610 TAY
620 LDA &80
630 CLC: ADC &82
640 TAX
650
660 \ draw line
670 LDA #5
680 JSR LIMO
690
700 \ repeat 255 times
710 DEC &89: BNE LOOP
720 RTS
730
740
750 .LIMO
760 \ routine to perform PLOT
770 PHA
780
790 \ store the coordinates
800 STX &85
810 STY &87
820 LDA #0
830 STA &86: STA &88
840
850 \ multiply X by 4
860 ASL &85
870 BCC L1
880 INC &86
890 INC &86
900 .L1
910 ASL &85
920 BCC L2
930 INC &86
940 .L2
950
960 \ multiply Y by 4
970  ASL &87
980 BCC L3
990 INC &88
1000 INC &88
1010 .L3
1020 ASL &87
1030 BCC L4
1040 INC &88
1050 .L4
1060
1070 \ VDU sequence of PLOT
1080 LDA #25
1090 JSR OSASCI
1100 PLA
1110 JSR OSASCI
1120 LDA &85
1130 JSR OSASCI
1140 LDA &86
1150 JSR OSASCI
1160 LDA &87
1170 JSR OSASCI
1180 LDA &88
1190 JSR OSASCI
1200 RTS
1210
1220
1230 .NEGAT
1240 \ to divide negative byte by 16
1250
1260 \ reverse sign
1270 STA &8A
1280 LDA #0: SEC: SBC &8A
1290
1300 \ divide by 16
1310 LSR A: LSR A: LSR A: LSR A
1320
1330 \ reverse sign again
1340 STA &8A
1350 LDA #0: SEC: SBC &8A
1360 RTS: ]
1370
1380 NEXT O%
1390 ENDPROC
```

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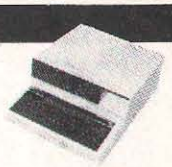

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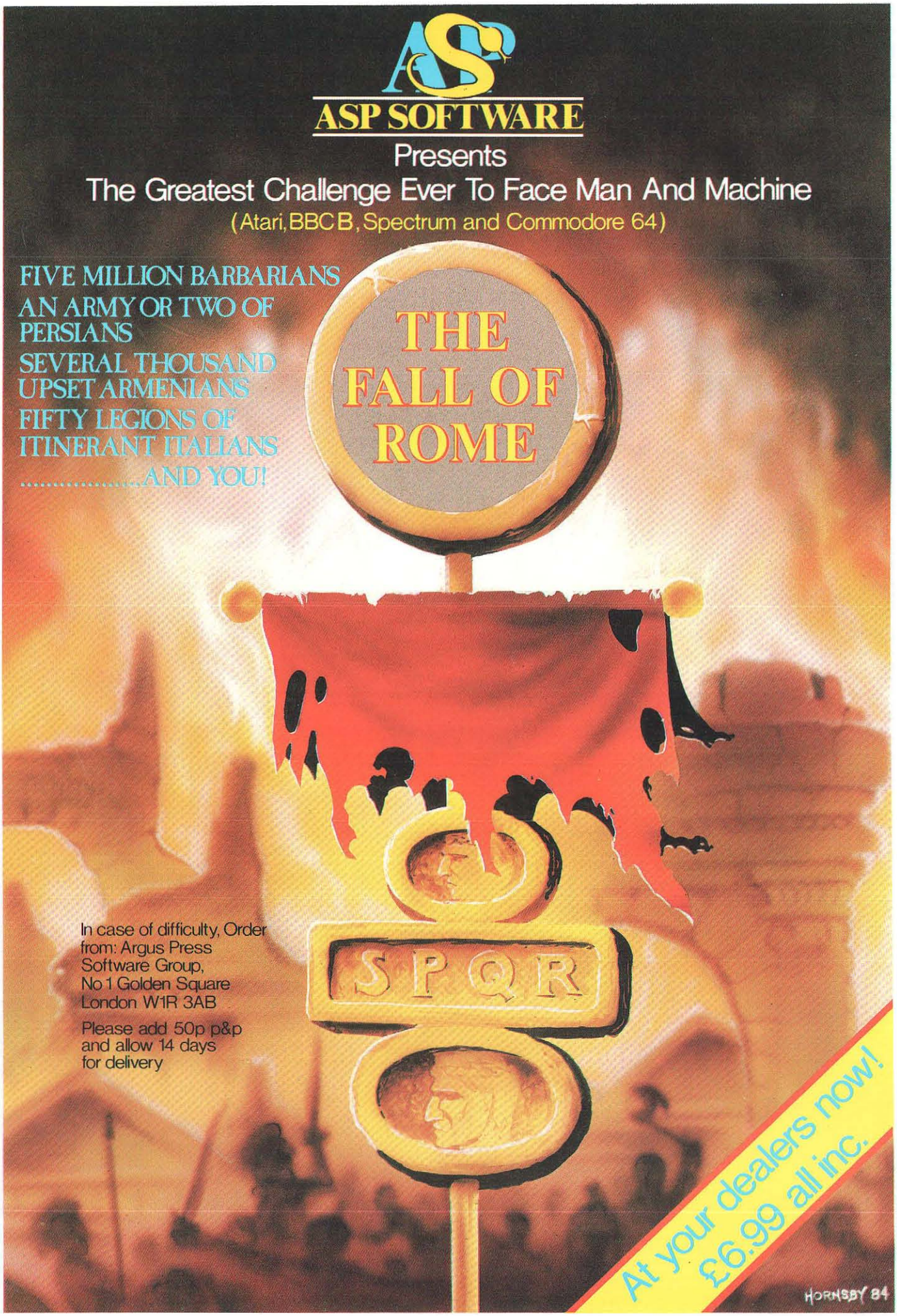
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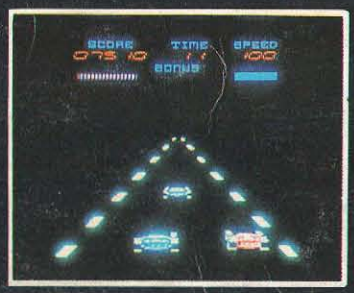

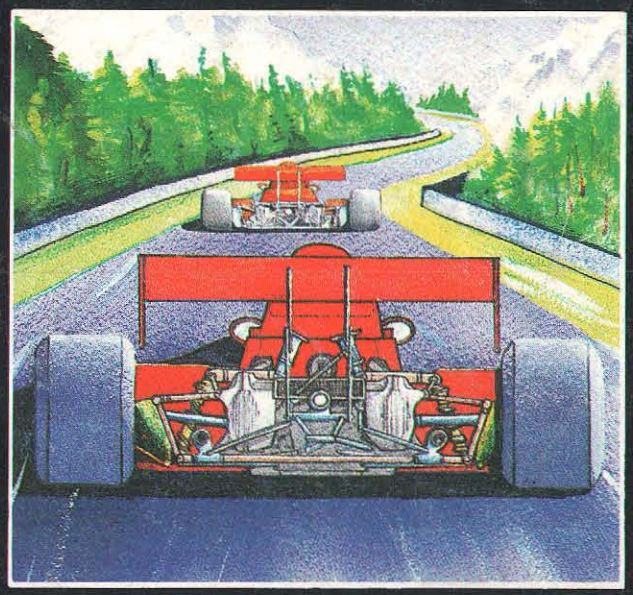

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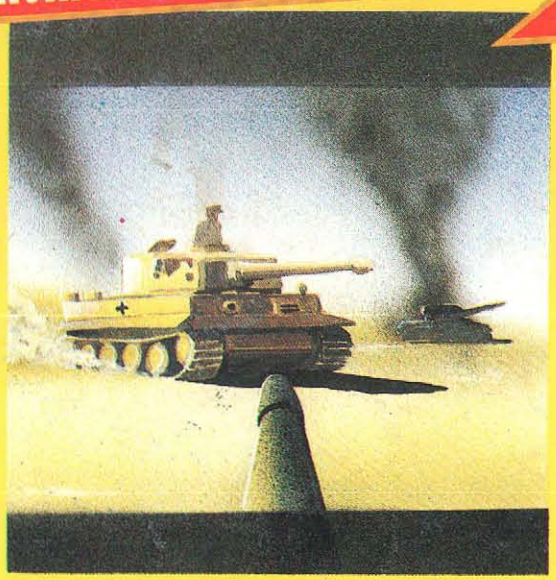

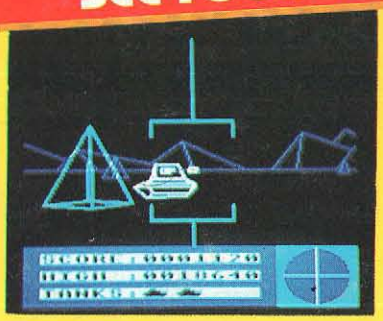

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